MANUAL OF RECOVERY ROOM CARE



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MANUAL OF
RECOVERY ROOM CARE

by

Members of the Department of Surgery
The New York Hospital–Cornell Medical Center

Edited by JOHN M BEAL M D

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To

EUGENE HILLHOUSE POOL

(1874–1949)

Former President of the American Surgical Association, Society of Clinical Surgery American College of Surgeons, the New York Academy of Medicine, the New York Surgical Society and former President of the Medical Board and Honorary Governor of The New York Hospital whose continuous association with The New York Hospital for forty nine years is remembered

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Preface

It is now recognized that most postoperative complications have their inception in the hours immediately following surgery Therefore, the hospital recovery room, with its well-trained staff, special apparatus, drugs, and replacement fluids, has become an increasingly vital adjunct in the care of anesthetized or recently anesthetized patients in this immediate postoperative period

This *Manual of Recovery Room Care* presents in concise form the salient points in the management of patients after general surgical procedures as well as after operations in the surgical specialties It was written by members of the Department of Surgery of The New York Hospital–Cornell Medical Center, where a program of special education was instituted in 1952 for the nursing staff assigned to the recovery room Such a program was deemed necessary because of the inevitable changes in the staff as time passed

Although it is obvious that each institution has its own administrative methods physical peculiarities and problems in staffing certain general principles apply to all recovery room units if maximum efficiency in patient care is to be achieved It is to be remembered that the facilities and equipment of a recovery room are not as important as an alert trained and responsible staff Accordingly it is hoped that the following chapters may serve as a guide for instruction and reference to all who have responsibility of patients in a recovery room—whether in institutions where recovery rooms are already in existence, in those planning to establish recovery rooms, or in those planning to alter existing arrangements

The efforts of the many resident physicians and members of the staff of the Department of Surgery of The New York Hospital, who have participated in the training program of the recovery room are gratefully acknowledged Particular recognition is extended to Dr C G Child, III, for his contributions to the establishment of the

recovery room, and to Dr Richard B Stark, who was responsible for the training program Lastly, it has been due to the encouragement of Dr Frank Glenn, surgeon in chief of The New York Hospital, that the material in this book has been assembled

JOHN M BEAL M D

Foreword

The New York Hospital, with its magnificent heritage in the broad field of surgery, with its great roster of distinguished pioneers and practitioners of the art has also for practically half a century been aware of the invaluable role of the recovery room in the successful outcome of surgical procedures The recovery room at the hospital dates back to 1907 when the newly reconstructed operating theater of the hospital was finished and opened for service The interesting part of the reconstruction was the provision of two recovery room suites—accommodating three beds for females and two for males These were located on opposite sides of a corridor leading from a smaller operating room to a larger one of the amphitheater type—adjacent to the surgeons dressing room and in full view of passing nurses and doctors

Anesthesia in this period was commonly of the open ether type—attaining deep planes of narcosis with consequent long periods of recovery—which slow awakenings to full consciousness were often attended with considerable noisiness and general excitation The recovery rooms were obviously planned to isolate the patient emerging from the depths of anesthesia from the other patients in the public wards which were of the open type

It was not long however, before techniques other than those of isolation and restraint were coming into use These rooms were used for the treatment of shock before and after surgery They became the natural place to begin the administration of fluids—rectal drips and taps giving way to hypodermoclyses—and these in turn to intravenous infusions of fluids and later blood Blood banks were not in existence—registered donors being summoned by telephone or via the New York City Police Department Many times the need for blood was anticipated and the donors were at hand in

a good many cases urgent blood needs were supplied by donors from the house staff, who welcomed the fee allowed

The person most closely associated with the establishment of the recovery room at The New York Hospital was Dr Eugene Hillhouse Pool, who became an associate attending surgeon in 1907 As chief of the Second Surgical Division, Dr Pool was indefatigable in directing one of the great surgical services in the country He became known throughout the surgical world as a master surgeon and preeminent teacher Ever interested in the problems of the surgical care of patients and in research, he stimulated and was a constant source of inspiration to many students of the art of surgery, who have since gone on to their own individual accomplishments and recognition

Recently a number of Dr Pool s former students nurses, patients and friends established a memorial to his revered memory, and fittingly enough it was designated to participate in the endowment of the recovery room at The New York Hospital–Cornell Medical Center Today a suitably inscribed dignified bronze plaque is placed at the entrance of the recovery room I know that the professor could not have wished for a more proper memorial than this plaque and this book dedicated to him

FRANK J McGOWAN M D

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MANUAL OF RECOVERY ROOM CARE

General Considerations

RICHARD B STARK, M D

The recovery room is a place of concentration of (1) patients from the operating room who are still anesthetized or who are in the immediate postanesthetic period, (2) nurses with special training, (3) anesthesiologists and surgeons, and (4) special apparatus drugs, and replacement fluids, *with the aim* of giving the patient the same caliber of care in his immediate postoperative period as he received during his operation

Haphazard and improper postoperative care may negate completely all of the results of surgery which was carefully planned and executed under optimum anesthesia Because the skills and knowledge required for good postoperative care have increased enormously, an institution such as the postanesthetic room or recovery room has developed As the boundaries of ablative surgery are being extended due to better anesthesia blood replacement, and increasing knowledge of physiology as it relates to surgery, the needs for specialized care in the postoperative period have increased proportionately It is recognized now that the highest incidence of thrombosis and embolization, atelectasis, shock, or other postoperative complications has its inception in the hours immediately following surgery

At the same time the supply of nurses is decreasing generally As the need for complicated postoperative care must be performed by fewer personnel it becomes apparent that such care cannot be administered upon each floor

It is felt by administrators of institutions with recovery rooms that the recovery room represents an added expense but is economical in its conservation of nursing personnel A smaller number of

CHAPTER II

Administrative Considerations

TRACY F STORCH

The inception of recovery room service at The New York Hospital was in 1944 Actuated by the acute wartime shortage of nursing personnel the institution s original recovery room was established in an operating room which was not being used at this time Despite its small size and limited capacity in relation to the volume of surgery performed the recovery room was a success

By 1948 the need for expansion of this service became more and more pronounced At that time, the facility was used only for pavilion (ward) patients Other patients were returned directly to their rooms following surgery Being widely dispersed throughout the hospital, these patients could not receive the same concentrated care which was available to the pavilion (ward) patients in the recovery room

In May, 1948 a Survey Committee submitted to the hospital s Operating Room Committee a report and recommendations for the long range improvement of the operating room service Included in the discussion supporting the recommendation that a central recovery room service be provided for all pavilion (ward), semiprivate and private surgical patients was the following statement It is only equitable that the private and semiprivate patients receive the same quality of care as the ward patients Further indication of the desirability of recovery room service, and need for its extension was indicated in a report submitted for presentation to the Hospital Administration through the Operating Room Committee by Charles G Child III M D attending surgeon, and Joseph F Artusio, Jr M D anesthetist in charge in January, 1949 This report noted "Today it can be stated categorically that an adequate recover room service

nurses is needed upon each floor, and these can concentrate their efforts upon daily and specialized nursing care as required Concentration of postanesthetic patients in one physical location makes the recovery room an ideal place for the teaching of early postoperative care of patients to student nurses, and, in most teaching hospitals, a small number of student nurses are rotated through the recovery room for a short period of training

The recovery room is an excellent area of training for residents in anesthesiology The concentration of anesthetized or recently anesthetized, patients in one physical location makes it much easier for the anesthetist and the surgeon to visit their patients who otherwise would be scattered throughout the hospital The recovery room therefore conserves time for the anesthesiologist the surgeon, the floor nurse, and the resident staff

The recovery room offers a degree of safety and comfort to the patient in the postanesthetic period not known heretofore This postoperative stay is good insurance of the patient s recovery during a hospitalization that may be shortened appreciably

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is a necessity to any hospital undertaking modern surgical therapy

Administrative acceptance of these principles and willingness to cooperate in implementing the proposals were self evident from past history of the recovery room However, the problems had to be faced of determining the physical requirements for an adequate recovery room service and of finding suitable space for such a facility Their solution depended upon coordinated planning Participants in the planning for the expansion of the recovery room service included representatives of the surgical and anesthesiology staffs, nursing service, purchasing department, and hospital administration

The first elements of planning to be considered were location and size Ideally, a recovery unit should be located on the same floor as and adjacent to the operating rooms Since the operating rooms in our main building are located on two floors this requirement was met only partially The recovery unit was established on one of the operating room floors and is on the floor immediately above the other operating room floor The bed capacity for a recovery unit is dependent on the volume and types of surgery performed and cannot be arbitrarily set on the basis of number of operating rooms or total surgical beds, for example The United States Public Health Service Hospital Facilities Section in advising hospital planners, suggests that each institution survey its own needs and practices and on that basis, arrive at the number of beds required for its recovery unit

The recovery unit at The New York Hospital contains 16 beds Twelve beds are located four each in three interconnected rooms, on the other side of a center corridor are a three bed room and a single bed room An average of 40 to 50 surgical procedures are performed each day and the 16 bed unit is adequate to take care of patients requiring the specialized service available in a recovery room

Other considerations in planning a recovery unit include a floor plan which permits observation of all patients simultaneously, and allows a good view of their faces At least one bed should be located in a separately partitioned space to accommodate the occasional patient whose care requires that he be isolated from the group There must be space between each bed, adequate for both personnel and equipment of all types, which may be brought into use Obviously doors should be wide enough to allow the passage of a bed

with apparatus on it Good lighting and a sufficient number of easily accessible and safe electrical outlets should be provided Adequate communications equipment, including emergency signaling system oxygen and suction equipment, air conditioning, and, if possible humidity control, and adequate plumbing including facilities for washing of hands, are all essential

The continued presence or immediate availability of every type of supply and equipment which may be needed determines in large measure, the effectiveness of a recovery room service In a hospital planning for such a service, this need not be looked upon as a major problem In most hospitals it requires only the reassignment of supply and equipment items which are already used throughout the institution

Policies governing the operation of the recovery unit also require consideration by the planning group Each hospital should establish criteria for selection of patients requiring recovery room service What shall be the policy as to visitors? Should a private duty nurse be used to assist in the care of her patient in the recovery room? To what extent shall patients be separated in regard to type of accommodation private semiprivate, ward, and sex? There is also the question of what charges if any should be made for this specialized service

At The New York Hospital all patients who have had a general anesthetic must go to the recovery room from surgery Visitors are allowed only if the patient has been placed on the critical or serious list A private duty nurse is expected to assist in the care of her patient Patients are mixed without regard to sex or accommodation while in the recovery unit

In the matter of charges it must be recognized that the recovery room service is an intensive and specialized one and that it does cost money to provide such service Rather than increase charges for unrelated services, it is better to establish a system of charges for patients receiving recovery room service At this hospital the principle of charging for any stay longer than one half hour was adopted when the recovery unit was opened The fee charged originally was the same regardless of type of operation or length of stay Experience dictated the need for a sliding scale of charges Since our operating room charges had already been graded on the basis of com-

plexity and average time, the recovery room fees were correlated with the operating room charges At the present time, these fees range from $10 00 to $25 00

All of the foregoing are important considerations in planning for a recovery room service Certainly, the more efficient use of personnel and equipment the greater safety to patients and the reassurance to their families which such a concentration of effort assures and the avoidance of transporting and dispersing non reacted, or partially reacted postoperative patients throughout the hospital are factors which merit the attention of economy-minded and public relations wise administrators

CHAPTER III

Recovery Room Nursing

GLADYS JONES R N

The responsibility for the care of the postoperative patient is shared by the surgeons, the anesthetists and the nurses The role of the nurse in the recovery room demands a sound basic knowledge of her field as well as technical ability

An in-service educational program has been found invaluable for orientation of a nurse to her responsibilities in this particular area of nursing Such a program should include demonstration and discussions and the subjects that are covered should include anesthetic agents, surgical procedures with special emphasis on nursing care, and the use of special apparatus and equipment (Emerson respirator, oxygen therapy, suction, endotracheal tubes etc) This program should be planned for the graduate nursing staff and can be presented by the anesthetists, surgeons, and recovery room nursing staff

Student nurses profit from time spent in the recovery room and, in our institution, they spend one of their total six weeks operating room assignment in the recovery room The student nurse has been introduced to the recovery room by a two hour formal class given by the supervisor of the recovery room This class outlines the nurse s responsibilities and provides demonstrations of procedures and equipment which are used in the recovery room When the student is working in the recovery room informal classes are conducted In this instruction particular reference is made to (1) the care of the unconscious patient with emphasis on the importance of maintenance of a patent airway (2) care of the hyperactive and disoriented patient with emphasis on the importance of protection

of the patient from self injury and the factors involved in the control of pain and restlessness

Bedside teaching is of great importance in this area and can be provided more effectively if the number of student nurses assigned to the recovery room is small The experience is of great value to the student nurse because it provides the student with an excellent opportunity to further develop her powers of critical observation

Nursing Responsibilities

The main responsibilities of the nurse in the recovery room are *constant careful* observation of the patient and observation of any mechanical device which is used to promote the patient s recovery

The patient who has received either general or spinal anesthesia is placed in his bed following completion of the operative procedure and is accompanied by the anesthetist to the recovery room In recovery rooms where space is a problem, special recovery beds are now available which are not as wide as the usual hospital bed and are easily moved in all directions In our institution the patient s own hospital bed has been used because the patient has to be transferred only once, from the operating table to the bed, an important factor in seriously ill patients

When the patient arrives in the recovery room the anesthetist reports the procedure that has been performed and discusses with the nurse any problems which are present or must be anticipated in the care of the patient

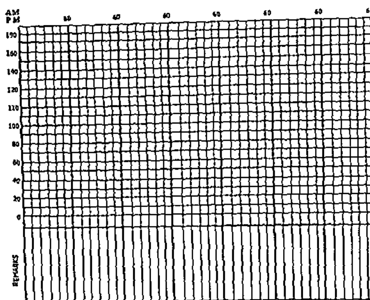
The nurse then checks the patient s color and the quality of respiration (depth, rate and sound) Oxygen is given by mask to patients who have not reacted The blood pressure, pulse, and respirations are checked with the anesthetist These vital signs are checked every 20 minutes, unless it has been ordered that they should be checked more often This information is recorded It is advantageous to use a special form for the recovery room The type that is shown (Figure 1) has been printed on the reverse side of the anesthesia record in this institution and readily provides the essential information in a manner that can be rapidly visualized The patient s dressings are observed for drainage and catheters if present, are attached to the appropriate receptacles for proper drainage

A well padded leg restraint is used if a patient has intravenous infusion or transfusion in the leg or foot veins and armboards are

RECOVERY ROOM RECORD

CONDITION ON ARRIVAL GOOD FAIR POOR
CIRCLE ONE

TIME OF ARRIVAL IN RECOVERY ROOM A M ____ P M ____



CODE ● PULSE O RESPIRATION V V BP

MEDICATION GIVEN IN R R

T E	DRUG	DOSE	Route	S

OXYGEN THERAPY

ROU E		Time	On	Off
MASK				
NASAL				
TE T				
OTH R				

OUT PUT	AMOUNT	TI E	TO L

FLUID THERAPY

	SALI E	BLOOD	5% DEXTROSE/W	B MOUTH	OTHER
OPERATING ROOM					
RECOVERY ROOM					
OTHER					

RECOVERY TIME
CONSCIOUSNESS
NAUSEA
VOMITING TIMES
CONVULSION
DELIRIUM
SENSATION (post spinal)
OTHER
DRESSINGS YES NO
DRAINAGE YES NO
TYPE
TRANSFERRED TO PAVILION AM PM
Condition GOOD FAIR POOR

REMARKS ____

Figure 1 Recovery room records should be concise and easily maintained This form provides a rapid visual appraisal of the patient s progress and is printed on the reverse side of the anesthesia record at The New York Hospital

employed to stabilize the upper extremity if intravenous fluids are running into a vein in the arm The extremity is checked frequently for infiltration If infiltration does occur, the nurse should be authorized to start the infusion again The doctor s order sheet is checked and medications and/or treatments are carried out as indicated

The patient remains in the recovery room under constant ob servation until his vital signs are stabilized and he is oriented as to time and place The patient must be alert enough to be left unattended and to call a nurse if necessary after removal from the recovery room Each patient is observed by the nurse in charge before he is returned to his room If there is any question about the patient s safety the surgeon is contacted before the patient is moved The patient is accompanied by a nurse and an orderly when he is moved from the recovery room In our opinion, the presence of the nurse assures greater safety for the patient The nurse from the recovery room gives a verbal report of the patient s condition and presents the doctor s order to the nurse on the floor The average length of stay for patients in the recovery room in our institution has been three hours However, the patient may stay for any length of time if the surgeon feels that the patient should not be moved from the recovery room

Administrative Considerations

The quality of patient care is dependent upon the efficiency of the nurses For this reason a permanent staff of nurses should be as signed to the recovery room and no other assignments should be made to the recovery room staff

The permanent nursing staff for our recovery room of 16 beds consists of one supervisor one head nurse and six graduate staff nurses Each works an eight-hour day and a 40 hour week The graduate staff nurse has one night on call each week from 12 midnight until 8 A M This is done in order to provide 24 hour coverage of the unit, in case of emergency surgery or in the event a patient s condition warrants stay in the recovery room past midnight

In a hospital such as ours where there is no scheduled surgery on the week end, Saturday and Sunday are covered on an on call basis The 48 hour period is divided into four 12 hour periods and each of two nurses covers a total of 24 hours The hours are divided so that each nurse is not on duty for more than 12 hours

The distribution of the staff which is given on the sample time sheet (Table I) provides the best coverage for the maximum patient load in the recovery room, which usually occurs between 12 noon and 6 P M This also allows for the several patients that may still be in the recovery room after 7 P M Some recovery rooms function on a 24-hour basis and, for these, appropriate adjustments in staff must be made However, the plan that has been outlined is most efficient for the majority of hospitals Unless there is a very active emergency service with many operations during the night hours, the arrangement which has been described will work well

Besides the regular nursing staff, the recovery room requires an auxiliary staff (Table II) For a unit which approximates the size described herein, one floor clerk, one nursing aide, and two orderlies are a minimum requirement The floor clerk works during the most active hours from 10 A M until 7 P M She is responsible for answering the telephone, sending messages to the floors, and for keeping an inventory of necessary equipment The clerk orders supplies of linens, items from general stores, sterile supplies, and drugs The clerk also prepares the list of recovery room charges for the hospital accounting department The floor clerk s desk must be situated so that all traffic into and from the recovery room can be observed Thus she can direct the new admissions into appropriate spaces and keep the list of the patients who are in the recovery room A black board near the entrance of the recovery room is valuable for this purpose (Figure 2) This board enables a surgeon to find the loca tion of his patient quickly when he comes to the recovery room without asking recovery room personnel

The nursing aide is responsible for the preparation of the patient s bed so that it is ready when the operation is completed The aide is available for emergency errands to the blood bank, central sterile supply, or other locations She also assists the staff nurses in turning patients and changing bed linen A tour of duty from 8 A M to 4 30 P M has been found most satisfactory for the nursing aide

The orderlies are delegated the responsibility of maintenance of much of the recovery room equipment such as airways needles, syringes and suction catheters These items must be removed from the rooms cleaned, and when necessary autoclaved In the evening, the orderly must check and restock each room in preparation for the next day The orderlies also assist the nurse in transporting the

[Text continued on p 14]

NEW YORK HOSPITAL – CORNELL MEDICAL CENTER

HOURS OF NURS G SERVICE AND STUDENT EXPERE CE

Pav lion Recovery Room

Week F

NA E	Da / T le	3 MO DAY on ty	4 T E D on duty	5 ONESDA on duty	6 URSDA on duty	7 FR DA on d ty	8 SA URDAY on ty	9 SU DA on duty	TO AL HOURS
Miss A	Sup	8 5	8 5	8-5	8 5	8 5	X	X	
		8	8	8	8	8			
Miss B	H N	9-6	9-6	8 5	9-6	9-6	X	X	
		8	8	8	8	8			
Miss C	GSN	1-10	3-12	10-7	O T *	10-7	X	X	
		8	8	8	8	8			
Miss D	GSN	10-7	1 10	3 12	10-7	10 7	X	X	
		8	8	8	8	8			
Miss E	GSN	10 7	10-7	1-10	3-12	X	8 PM-8 AM Call	8PM-8AM Call	
		8	8	8	8				
Miss F	G^N	10-7	10-7	10-7	1 10	3-12	X	X	
		8	8	8	8	8			
Miss G	GSN	3 12	10-7	9-6	10-7	1-10	X	X	
		8	8	8	8	8			
Miss H	GSN	X	9-6	10 7	10-7	10-7	8AM-8PM Call	8AM-8PM Call	
			8	8	8	8			
* O T indicates owed time for h urs worked dur g nights – on c ll									
		Miss C.	Miss D.	Miss E.	Miss F.	Miss G.			

TABLE I

SAMPLE TIME SHEET FOR RECOVERY ROOM NURSING PERSONNEL — PERMANENT STAFF

TABLE II

SAMPLE TIME SHEET FOR RECOVERY ROOM NURSING PERSONNEL — AUXILIARY STAFF

NEW YORK HOSPITAL — CORNELL MEDICAL CENTER

HOURS OF URS G SERVICE AND STUDENT EX ER ENCE

Pav lon Recovery Room W k of

E	Date / T	3 MO DAY on duty	4 TUESDA on d ty	5 WED ESDAY on duty	6 T URSDAY on d ty	7 FR DA on duty	8 SAT RDAY on duty	9 S DAY on duty	TO AL HOURS
Auxiliary Staff									
Miss R	Fl Cl	10 7	10-7	10-7	10-7	10-7	X	X	
		8	8	8	8	8			
Miss S	N A	8-4:30	8-4:30	8-4:30	8-4:30	8-4:30	X	X	
		8	8	8	8	8			
Mr T	Ord	10-7	10-7	10-7	10-7	10-7	X	X	
		8	8	8	8	8			
Mr W	Ord	3:30-12	3:30 12	3:30-12	3:30 12	3:30-12	X	X	
		8	8	8	8	8			

patient to his room or ward At least two orderlies are required for the activities, one of whom works from 10 A M until 7 P M and the other from 3 30 P M until midnight

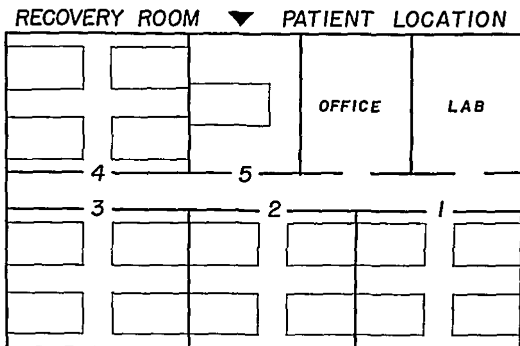


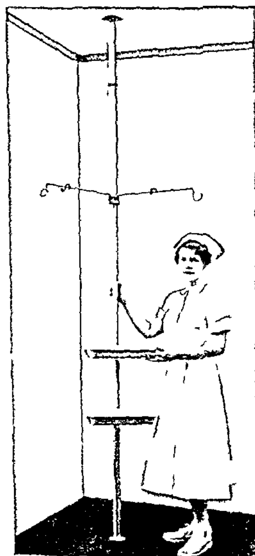
FIGURE 2 This blackboard diagram has been placed near the entrance to the recovery room so that the staff may locate patients easily The diagram is painted on the blackboard and the names of the patients are written in chalk

Physical Arrangement

The physical arrangement of the recovery room is of course influenced by the structural limitations of the hospital in which it is located Although many institutions have found that a recovery room of one large ward is satisfactory, our experience and investigations have led to the recommendation of a unit which is composed of multiple rooms Ready access and easy communication between the rooms are required In addition a single bed unit should be included This is needed for isolation purposes or for a seriously ill patient who is to be visited by the family Each room should be large enough to accommodate four beds with accessory equipment The division of the recovery room into separate units has the following advantages exceptionally noisy or restless patients may be separated children may be separated from adults whenever it seems necessary more

privacy for a patient may be required under unusual circumstances In addition, when the recovery room is opened at night, it is necessary to open only one room

Each bed and its necessary equipment constitute a unit within the recovery room Each unit should contain a source of oxygen and mask blood pressure apparatus, and a source of suction In our institution the Polecat (Figure 3) has replaced the bedside stand



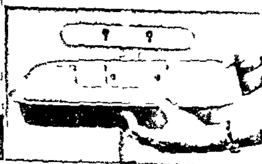


FIGURE 3 The "Polecat" has the advantage of occupying a small area while space is provided for trays and infusions (Courtesy of Polecats Inc Saybrook Connecticut)

and infusion pole The removal tray serves to store tongue blades, emesis basin, towels, adhesive tape, and tissue wipes One suction machine for aspiration of the nasal and oral pharynx is required for

every two beds Bed side rails must be available for hyperactive patients Each room should have two closets or cabinets—one for sterile supplies solutions for infusions, and tubing, the other for linen Each room is supplied with equipment and materials needed for the care of the patients

Emergency drugs and equipment must be stored in a central location and must be available for immediate use The emergency equipment must include cardiac arrest trays, endotracheal tubes, laryngoscopes, cut down infusion sets, tracheotomy trays, post tonsillectomy trays, and urological trays (see Chapters XI and XII)

The combination of trained personnel and the centralization of necessary equipment provides much safer care for the postoperative patient In this regard the recovery room should have a policy that a patient must not be left at any time in a room without a nurse There are certain disadvantages, largely psychological to the patient and to the patient's family Preoperative orientation can eliminate anxiety for both the patient and his family Visitors should not be allowed in the recovery room unless the patient is critically ill It is important that the staff maintain liaison with the family which will allay apprehension while the patient is still in the recovery room The clerk can function well in this respect

The fact that the nurse in the recovery room does not see the patient before he arrives in the unit can present a problem For example, the nurse may not know whether the patient has a language problem or if he was unusually apprehensive before the operation Complete notes written by the nurse who has cared for the patient before operation are helpful to the nurses in the recovery room when the patient's condition is evaluated after operation

CHAPTER IV

Respiration, Circulation, and Pain in the Recovery Room

JOSEPH F ARTUSIO JR, M D

The majority of patients placed in the postoperative recovery room have not fully regained consciousness In this unconscious state upper pharyngeal and laryngeal reflexes may be absent or obtunded If vomiting or regurgitation of gastric secretions occurs at this time there is the possibility of aspiration of this material into the tracheobronchial tree It thus becomes mandatory that the positioning of the patient be an important part of the early recovery room care The patient s position should be such as to mediate against airway obstruction from any cause The patient may be placed supine or in the lateral position If the full supine position is used the patient s head must be turned to the side rather than be allowed to remain in the upright position *The upright position of the head invites disaster* The lateral position is perhaps the safest from a respiratory standpoint, in that the soft parts in the pharynx tend to fall away from the opening of the tracheobronchial tree also vomitus and regurgitated gastric contents will tend to gravitate to the outside of the body rather than into the respiratory tract However the advantages of the lateral position may be negated in patients with ventilatory depression emphysema and other pulmonary pathology Further diminution of ventilation, due to the lateral position may occur to the point where cyanosis becomes apparent In this situation the supine position is to be preferred

When the patient is relatively safe from a positional standpoint, his respiration should be examined Normal ventilation is characterized by a chest wall that rises as the diaphragm descends in a

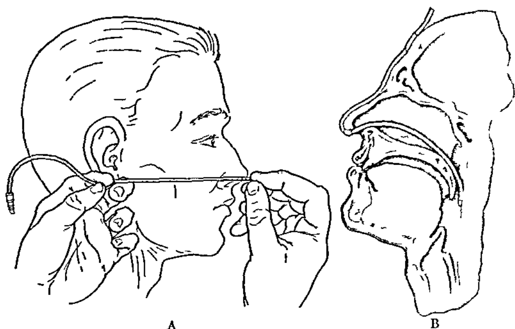
smooth, integrated action The thoracic ascent should be active and the diaphragmatic descent full and without effort Any interference with this coordinated, smooth, active breathing means hypoventilation and demands immediate and adequate treatment If the thoracic wall retracts with each diaphragmatic descent, there is some obstruction in the respiratory tree A noisy respiration may call attention to the fact that the airway is not completely patent, but this serious problem may be completely quiet and unobtrusive If hypoventilation is present, several possibilities should be considered as to the possible cause of this situation and its treatment

First, one must determine if the obstruction is in the upper respiratory tract This can usually be accomplished by lifting the jaw or inserting an oropharyngeal airway and suctioning the region of the mouth and pharynx If the smooth, coordinated action of breathing resumes immediately upon this method of clearance of the upper respiratory tree the problem has been handled satisfactorily If it becomes obvious that the upper respiratory passages are clear, but respiratory difficulty still persists, one must then proceed to determine a cause lower down in the respiratory tree

Obstructions lower down in the respiratory tree at either the larynx trachea, bronchi, or alveoli, need the immediate attention of a physician to determine the exact etiology and to proceed with specific treatment With widespread use of muscle relaxants today (the curare and curare-like compounds), obstruction may not be present, but hypoventilation may be due to the persistent action of these drugs on the respiratory musculature

In situations where inadequate ventilation is present, which cannot be remedied by providing the patency of the oral airway the patient should immediately be placed in a high concentration of oxygen during the period of waiting for the arrival of a physician Oxgyen may be given by one of three ways by the nasal pharyngeal catheter, the face mask or the oxygen tent Each of these methods has its place in recovery room oxygen therapy depending upon the reactions of the patient and personal preference

The nasal pharyngeal catheter (Figure 4) is placed in the nose with the oxygen running then is advanced into the pharynx until the patient begins to swallow air It is then withdrawn slightly until the oxygen is no longer swallowed The catheter is now in the best possible position for the highest percentage of oxygen in the inspired



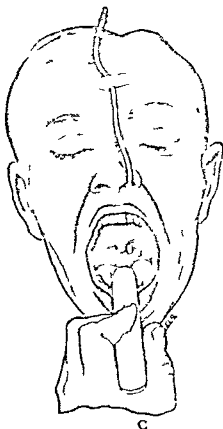
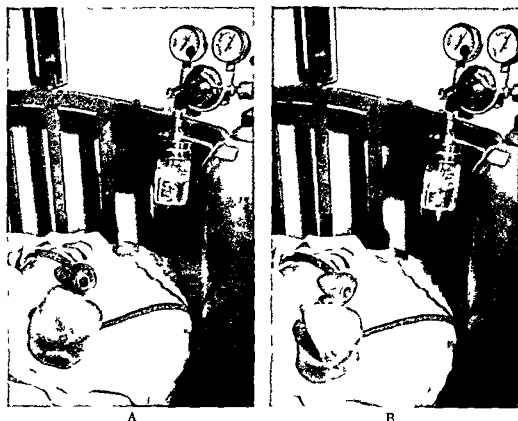


FIGURE 4 *A* Illustrates the method of approximating the distance that the nasal pharyngeal catheter should be inserted in the nose by measuring the length from the external nares to the tragus or ear lobe

B The sagittal view shows the nasal catheters in place and shows the numerous holes in the tip so that a stream of oxygen will not be directed against any one region of the pharynx

C The full face view shows the only certain method of checking the location of the tip of the nasal catheter in the unconscious patient If the catheter tip is too high a lower oxygen concentration than desirable will be delivered If the catheter tip is too low oxygen will pass down the esophagus and distend the stomach This figure also illustrates the adhesive marker placed on the catheter at the external nares to fix the proper distance that the catheters are reinserted after cleaning

To ensure stability the catheters may be taped to the forehead



A B

FIGURE 5 Shows method of administering oxygen by mask to an unconscious patient with an intact respiratory drive An "OEM mask is used because there is no accumulation of carbon dioxide The patient is in the lateral or Sims position which tends to maintain the upper airway by letting the base of the tongue fall away from the pharyngeal wall and which tends to decrease aspiration of mucus and vomitus

A and *B* show the bag fully inflated and very slightly deflated by inspiration The bag should continuously fluctuate between these two positions if the patient is breathing properly and the oxygen flow is correct Should the bag remain inflated the patient is either obstructed or is in apnea or the oxygen flow is too high If the bag is completely deflated as in *C* (see opposite page) either the oxygen flow is inadequate or there is a leak about the face mask

air This catheter should be multi eyed to prevent dehydration of the nasal or pharyngeal mucosa and the oxygen is best administered to the patient following humidification by bubbling the incoming gas through a water bottle The percentage of oxygen usually delivered by this method is 40 per cent

The face mask is the second form of oxygen therapy and the most effective, as it produces the highest concentration of oxygen in the inspired air (Figure 5) For this use the meter mask is to be preferred It is easily regulated and easily cleaned Occasionally the



In *C* a flow of 10 5 liters per minute did not maintain the necessary distention Therefore a leak about the face mask exists In this instance an oxygen flow of 10 5 liters per minute was required to maintain the bag at the proper degree of distention

A humidification bottle is also illustrated Ordinarily this bottle is not included when oxygen is administered by mask but a humidification bottle is desirable when oxygen is administered by nasal catheter

mask is disturbing to the patient, and in those cases the nasal pharyngeal catheter or oxygen tent may be resorted to

The oxygen tent is the third form of oxygen therapy which may be used in the recovery room It of course makes patient care more difficult, but in patients who require a lower environmental temperature or high humidification, in conjunction with oxygen therapy the tent is of great value It provides the lowest concentration of oxygen in the inspired air The high humidity tent of the latest design has an important place in recovery room care for patients who have laryngeal obstruction from edema It is also of great value for children from this standpoint, children have a greater incidence of subglottic edema following endotracheal intubation The high humidity tent with or without the use of the detergent agents helps to liquefy secretions and allows them to be more easily coughed from the tracheobronchial tree

Hypoventilation may be due to persistent drug action in the presence of a completely patent tracheobronchial tree and placing the patient in a high oxygen atmosphere may not be sufficient to produce

adequate oxygenation and carbon dioxide removal Depression of ventilation, whether due to central depression or peripheral neuro muscular blockade, is best handled by artificial ventilation with 100 per cent oxygen Treatment of central respiratory depression with drug therapy is of little value Manual or mechanical artificial res piration should be carried out by a simple mask and bag or a com mercial resuscitator (if available), until the period of central respira tory depression is over If depression of ventilation is due to the persistence of a curare action, artificial ventilation with 100 per cent oxygen remains the best form of therapy, but the resuscitation may be shortened by the use of an anti curare agent if the curare involved is either *d* tubocurarine or gallamine (Flaxedil) If the persistent peripheral blockade is due to decamethonium (Syncurine) or succinylcholine artificial ventilation with 100 per cent oxygen is the only available treatment

Throughout the recovery room stay the blood pressure, of course, is recorded at definite intervals, and episodes of hypotension must be carefully followed Hypotension may be of serious import, especially if it is associated with a perspiring pale patient and an accompanying rapid pulse Hypotension of this variety is usually related to an inadequate circulatory blood volume, and, of course, immediate whole blood is the treatment Other hypotensive states which are associated with a warm dry patient slow pulse, and an appearance of well being do not have the serious import of the former state The latter state is frequently seen following cyclopro pane anesthesia and needs little therapy Vigorous replacement of whole blood in this situation may produce overloading of the circula tion with subsequent pulmonary edema

Control of pain in the early postoperative period should be individualized The narcotic drugs should be used carefully, especially in situations where there is an unstable circulatory system due to arteri osclerosis diminished blood volume, or myocardial insufficiency This applies particularly to the geriatric patient Attempts to com pletely relieve postoperative pain by narcotic action also introduce a peripheral circulatory stress due to a peripheral dilatation pro duced by these drugs Hypotension often ensues, with associated myocardial ischemia, and may produce a fatality Pain should be ameliorated or lessened in all postoperative patients but especially in the older age group, too vigorous treatment of pain may be disas trous to respiration and circulation

CHAPTER V

The Administration of Intravenous Fluids in the Recovery Room

DANIEL M HAYS, M D

The recovery room personnel are concerned with starting and maintaining the flow of intravenous fluids and blood This presents unique and important responsibilities The intravenous route is associated with far more dangers than any other means of administering substances to the body (i e, oral rectal subcutaneous, etc) The patient can be said to be literally at the mercy of the individual who places a needle in his vein This section is a brief outline of the usual equipment techniques dangers, and safeguards of intravenous therapy as it is used in the recovery room

A *Inherent Dangers in the Administration of Any Intravenous Fluid*

The most dramatic disaster associated with the use of the intravenous route of fluid administration is air embolism A simple infusion without pressure even when completely unattended cannot force air into the veins Air embolism usually occurs during the use of pressure to achieve a high rate of flow in blood transfusion Once any bottle has been subjected to pumping, it should be observed continuously throughout the remainder of its period of flow The use of a second bottle of fluid in tandem is desirable under these circumstances, so that fluid rather than air, would follow the blood into the vein The use of blood under pressure in the recovery room is usually a matter of emergency but the secondary danger of air embolism must be kept in mind constantly when it is employed Manual devices which are attached to the tubing and propel the blood between the bottle and the patient without the use of air under pressure eliminate this danger

During the administration of fluids and blood (without pressure), the infusion system empties sometimes before the bottle can be replaced and air fills the upper portion of the tubing This should be corrected by a preparation of an entirely new set (down to the needle) The addition of a second bottle of fluid without this precaution will infuse the air in the upper portion of the tubing into the vein For safety the tubing should be changed whenever air in any quantity appears in the lumen of the tubing

A less dramatic but more frequently encountered problem associated with all types of intravenous therapy has been classified under the broad title of pyrogenic reaction This is probably produced by many different factors, but the clinical features are similar and striking The patient experiences a chill followed by a marked elevation of body temperature The chill may be unobserved and the rise in temperature may be the only sign discernible This sequence of events suggests at once that some noxious substance is passing into the patient through the infusion Although chills from many causes *may be seen in the recovery room it must be assumed initially that* the infusion (either blood or fluid) is responsible This means, of course that the bottle of fluid or blood which is running at the time of the chill or temperature elevation should be replaced at once (with another bottle of blood or fluid, needle and tubing) until a physician can determine more fully the source of these signs

B *The Dangers Peculiar to Whole Blood Transfusion*

The transfusion of incompatible blood is a constant danger in the recovery room Initial reactions from incompatibility of blood may be difficult to recognize in unconscious or semiconscious patients The usual basis for accidents which result in serious reactions of this type is a simple clerical error, i e errors in marking the blood or in the comparison of names and numbers on the blood bottle the chart, and the patient All three of these factors must be checked and rechecked before the blood is administered, i e, (1) the bottle (2) the chart, and (3) the patient himself The latter may seem superfluous but it is an important step Tragedy may result by comparing the numerical identification of the bottle with the chart, and by confusing the identity of the patient who is receiving the blood Both name and hospital number should be compared with those on the bottle Because it is possible theoretically to send the

wrong chart with the patient some hospitals have utilized the identification bracelet for patients who are going to surgery

The signs of a reaction to whole blood are usually similar to those associated with other pyrogenic reactors i e chill and fever, or simply fever alone *Chest pains restlessness, and apprehension may* be noted if the patient is conscious, with discoloration of the urine (pink) when the reaction is serious and well established Reactions are sometimes accompanied by generalized itching urticaria, and other allergic phenomena

Upon the occurrence of any of the above signs (chill, fever, urticaria, etc), the unit of blood being administered must be discontinued immediately The unit which is suspected of producing a reaction must be returned *at once* to the blood bank so that a careful check can be made of its compatibility

C *Rate of Flow in Intravenous Therapy*

Regulation of rate of flow of intravenous fluids is an important part of the care of the patient in the recovery room Criteria made in this regard may have many exceptions The patient in shock from hemorrhage may receive blood at a prodigious rate of flow The same rate of administration in the normotensive patient with a marginal cardiopulmonary reserve may produce pulmonary edema Three categories of patients in which a reduced rate of flow is of special importance are (1) children (2) aged patients and (3) cardiac patients Although in experiments using young animals, amazingly fast rates of fluid administration are tolerated (and this is true, to some degree in children), there are few advantages and surely potentially great dangers *in the frequent use of the rapid infusion*

The administration of 500 ml of fluid per hour (approximately 8 ml per minute or 2 gtt per second) might be regarded as the maximum rate of flow (except in emergencies) for use in young healthy adults For older patients patients with cardiac disease etc, a rate just half this fast, or 250 ml per hour (approximately 4 ml per minute or 1 gtt per second) is recommended The rate of infusions in *children is slower and in general* the rate should decrease in proportion to the size of the child

Blood plasma human albumin and saline present the major problems as far as the rapid fluid administration is concerned Iso-

tonic solutions of glucose (5 per cent dextrose in distilled water) are unlikely to cause difficulty

The number of drops per minute will vary with each type of dropping chamber and with each individual set and, hence, is but a rough index A periodic assay of the total amount of fluid received by the patient over a given time is necessary

D *The Types of Intravenous Fluids*

The basic solution for fluid administration in the recovery room is 5 per cent dextrose in distilled water This is the solution that should be turned to when (1) orders for fluid are not clear, (2) when it is known that the infusion is to be continued (cut down, for example), but the doctor s orders have not kept pace with the rate at which the infusion bottles have emptied and (3) when reactions occur and a rapid change of bottles is necessary (and other fluid has not been indicated specifically) This is the fluid that should be administered while awaiting specific orders from the physician *These orders should be sought and obtained as rapidly as possible*

Physiological (0 85 or 0 9 per cent) saline is the ideal solution for beginning and ending blood transfusion, although 5 per cent dextrose in distilled water may be used also for this purpose

Solutions containing protein hydrolysates (Aminosol, Amigen, etc) must be watched particularly for the occurrence of pyrogenic reactions Plasma, albumin and plasma substitutes are not cross matched and may be given to any patient

Clouding of the fluid sediment in the bottom of the bottle, or evidence that the bottle has been tampered with or opened is an indication to discard that particular bottle

Blood may be kept at room temperature for 30 minutes before administration but if further delay is necessary before transfusion, the bottle should be returned to refrigeration Blood should not be kept at room temperature longer if it is to be administered Plasma solutions are often kept at room temperature It is important however, that once the seal of the bottle is broken that it be administered promptly and not be permitted to become contaminated

E *Preparation of Equipment for Intravenous Infusion*

Preparing the bottle, tubing and needle for infusion involves establishment of an adequate air vent in the bottle and an entire

system filled with fluid running at a rapid rate Needles of size #20 or smaller may be used for infusion of fluid but if blood is to be used, needles of a caliber of #19 or larger are preferred Needles larger than #18 should be passed through the skin of a conscious patient only following the use of local anesthesia A small wheal is formed with 1 per cent procaine (or similar local anesthetic) Needles with a sharp point (long bevel) pass through the skin most easily, but they pass completely through the vein readily also A moderately dull needle is more reliable in venipuncture The needle is inserted into the vein in two steps, (1) through the skin and into the subcutaneous tissue and (2) into the vein with a portion of its length inserted into the lumen of the vein

Following insertion of the needle, the infusion should be tested by permitting rapid flow and then setting it at the standard rate Local adhesive tape fixes the needle to the skin and the extremity is restrained (except in the mid forearm or foot, where restraints may be unnecessary) Restraints consist of a well padded splint or of securing the entire extremity to the bed One should avoid any form of tourniquet or circular adhesive tape

F *Selection of Veins for Intravenous Therapy*

Recovery room personnel are called upon to start infusions as well as to maintain their flow

The common use of the large veins of the antecubital fossa for intravenous therapy is based on (1) their accessibility, (2) the relatively insensate skin and (3) the absence of complications Other prominent veins include those in the forearm the radial aspect of the wrist, and the ankle and foot Veins of the ankle and foot have been regarded as less advantageous because of the danger of phlebitis but this is relative only and, in many instances they constitute the most useful veins upon the surface of the body (Figure 6) Veins should not be used if the skin of the area shows signs of infection if they lie near the operative area or if they constitute varicosities (legs)

G *The Management of Intravenous Cut Down*

The recovery room nurse is often required to assist in the intravenous therapy of a patient with a "cut down infusion (Figure 7) This consists of sewing a large blunt needle cannula or plastic tub-

ing into the lumen of a vein It is often used in a patient in which superficial veins are absent and the maintenance of a continuous flow of fluids by this means is planned for several days Special

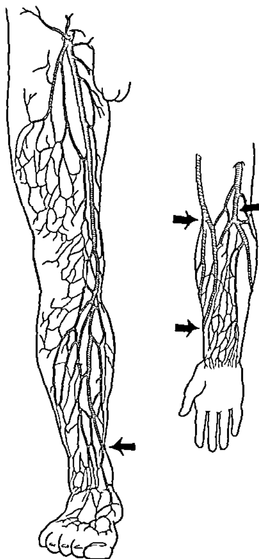


Figure 6 The most accessible sites of intravenous infusions are indicated The needle is not dislodged from the mid forearm as readily by motion and it is often preferred for this reason

efforts must be exerted to maintain flow of fluids since if the cut down fails, a second cut down is necessary

All of the precautions for intravenous therapy are applicable here The infusion set may be removed down to the needle if air enters the system or if a pyrogenic reaction occurs It must be replaced with new tubing and bottle The "cut down" needle, however, should be removed only by a physician

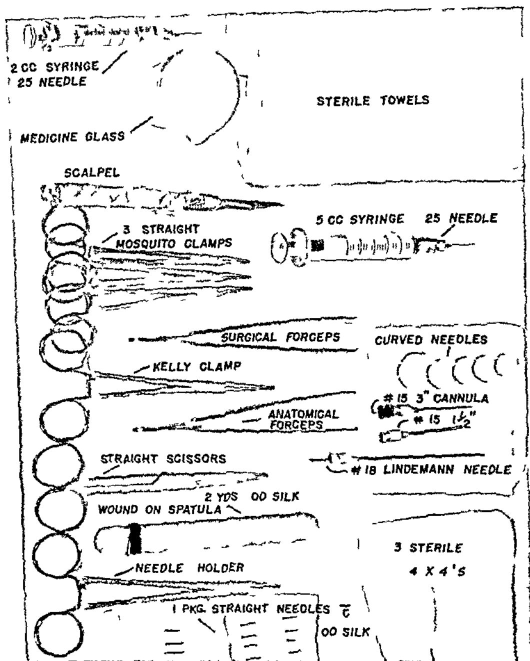


FIGURE 7 The essential equipment for venous cut down is shown

II The Painful Infusion

The conscious patient who complains of pain at the site of infusion during the administration of fluids may be (1) simply apprehensive, (2) reacting to potassium chloride chlortetracycline (Aureomycin),

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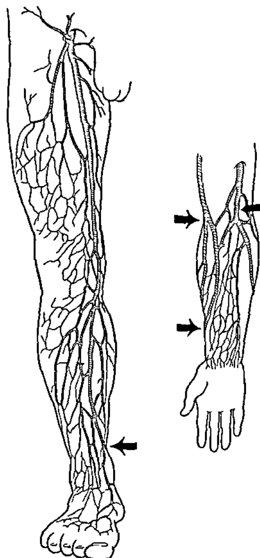


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CHAPTER VI

Care of the General Surgical Patient

JOHN M BEAL M D

Two primary concepts of patient care are given maximum consideration in the initial period of observation after surgical procedures First the chief goal of the alert and efficient care of the type represented in the recovery room is the prevention of complications Second the early detection of any untoward trend in the patient s course is sought Understanding of the potential dangers of operations in general must be taught those who are entrusted with this phase of recovery, and a knowledge of hazards that are peculiar to particular procedures must also be achieved

Some of the general problems have been brought out in the preceding chapters The possibility of cardiovascular and respiratory tract complications is present in every patient who has been subjected to operation Such systemic conditions as arteriosclerosis, hypertension, malnutrition, and serious infection increase the hazards of operative intervention The duration of operation and of anesthesia as well as the magnitude of the surgical procedure, have a direct influence on the frequency of postoperative complications The principles of care which relate to respiration and circulation have been outlined in Chapter IV The remarks in the present section will be devoted to the management of patients who have been subjected to the most common general surgical procedures, and attention will be directed to the problems peculiar to each

Post-Thyroidectomy

It may be considered that most thyroid operations are technically demanding of the surgeon but are not usually associated with blood loss of great magnitude The most frequently encountered complica-

etc , added to the fluid infused, or (3) in pain from infiltration of fluid into the subcutaneous tissues adjacent to the vein Pain due to chemicals and drugs may be eliminated by reducing the rate of flow Lowering the bottle below the level of the patient in order to test reflux of blood into the tubing is an acceptable test to determine whether the needle is inside or outside the vein

I *Concluding the Infusion*

At the end of the infusion, the recovery room nurse removes the needle (except a cut down needle) from the vein Firm pressure and massage at the site of the needle will prevent the formation of a hematoma, reduce subsequent pain, and preserve the vein for future therapy A small gauze dressing should be applied If conscious the patient is asked to exercise the extremity actively

with obstruction to the airway When both recurrent laryngeal nerves are injured, the cords may become fixed in a position of adduction This results in marked narrowing of the respiratory passage at the level of the vocal cords in the larynx and consequent labored respiration due to this obstruction Clinically, the patient may have crowing with obvious respiratory difficulty and an accelerated pulse Prompt tracheostomy is indicated in order to prevent a fatal outcome from the resulting anoxia

Tracheal collapse is fortunately a rare complication but must be anticipated where there has been marked tracheal compression and deviation due to a large goiter This complication may occur upon removal of the endotracheal tube, or within a few hours of operation as a result of retching vomiting or coughing This results in dramatic occurrence of complete obstruction to the airway Immediate tracheostomy is necessary

Pneumothorax in the postoperative period following thyroidectomy is most often seen after removal of substernal goiter It may occur also after total thyroidectomy Usually the entrance into the pleura is not suspected at the time of operation In many instances the pneumothorax may be small, and the signs and symptoms few A roentgenogram of the chest should probably be obtained in patients who have been subjected to operation for a goiter with substernal extension If the degree of collapse is extensive, the normal respiratory excursions are absent on the involved side, and vocal and breath sounds are markedly diminished, or absent in the same hemithorax The percussion note is usually tympanitic The patient may exhibit dyspnea cyanosis tachycardia and a fall in blood pressure The diagnosis may be confirmed by aspiration of the chest Removal of air will allow expansion of the lung and improvement in the patient s condition

The incidence of metabolic derangements has been markedly diminished since the introduction and general use of anti thyroid drugs in patients with hyperthyroidism A thyroid crisis may, on occasion, occur within the first 24 hours after operation and is manifested by tachycardia hyperthermia, restlessness increase in blood pressure and mental confusion Treatment consists of administration of morphine 10–15 mg every four hours and intravenous fluids of 10 per cent glucose, to which 1 gm of sodium iodide may be added twice daily The febrile response may be ameliorated by the cooling effect of an oxygen tent, by sponge baths or by ice packs

tions fall into two categories (1) those arising from local phenomena from the operative site, and (2) those related to metabolic derangements The former of these are more common, particularly in the early postoperative period Complications which may originate from local phenomena at the operative site are

1 Hemorrhage
2 Recurrent laryngeal nerve injury
3 Tracheal collapse
4 Pneumothorax

The first three of these complications have in common potential obstruction to the airway It is for this reason that a tracheotomy set must be readily available, preferably at the patient s bedside, for every thyroidectomy patient in the recovery room

Hemorrhage is one of the most serious complications after thyroidectomy The chief danger is obstruction to the airway by direct pressure upon the trachea Venous engorgement of the head may also occur The bleeding, which is usually of arterial origin and frequently from a branch of the superior thyroid artery, can produce significant obstruction to the trachea without detectable changes which would suggest shock A drain placed into the thyroid bed at the time of operation is felt by some to be an aid in detecting bleeding but will not prevent the complication from occurring Early local manifestations of bleeding are usually not apparent because bulky dressings about the neck are frequently employed for this operation If bleeding is suspected and the dressing is removed early in the course, local swelling in the anterior cervical region may be detected If a drain has been employed there will be bloody drainage on the dressings However in most instances, hemorrhage into the operative site is manifested by obstruction to the respiratory exchange slight cyanosis of the face and tachycardia Should these signs appear, the responsible physician must be notified promptly The dressing must be changed at once and the wound inspected If there is evidence of bleeding *it is imperative that the skin sutures be removed* and the clot evacuated Immediate action is required in this situation It is preferable that the patient be returned to the operating room so that adequate exposure and lighting can be employed in an effort to locate the site of bleeding In most instances a tracheostomy should be performed at once

Injury to one recurrent laryngeal nerve is usually not associated

mon Arteriosclerotic heart disease, hypertension, diabetes and generalized arteriosclerosis are frequently present and may contribute to problems in postoperative management Intraperitoneal hemorrhage is probably the most common serious complication that occurs following cholecystectomy that can be attributed directly to the operative procedure Bleeding may occur from an accessory cystic artery, from a ligature slipping from the cystic artery, from a tear in the omentum and from the liver and gallbladder bed The patient will show evidence of blood loss which will be manifested by a rapid pulse and falling blood pressure If a drain has been used the dressings will show evidence of blood It is to be emphasized that the amount of bloody drainage from the drain site is not an index to the extent of intraperitoneal bleeding The abdominal palpation will demonstrate evidence of peritoneal irritation but this is not entirely reliable in the first few hours after operation because of postoperative discomfort in and about the incision, and because of the depressed sensorium of the patient When intraperitoneal bleeding is suspected, the patient's blood should be properly crossmatched, hemoglobin and hematocrit determined and a transfusion started In most instances, exploration is indicated so that the bleeding point may be found and controlled

Atelectasis is a frequently encountered complication in the immediate period following cholecystectomy This complication frequently has its inception by the passage of the surgeon's hand over the dome of the liver or by the insertion of a pad above the liver in order to facilitate operative exposure This maneuver breaks the liver seal between the diaphragm and the dome of the liver, and results in limitation of the normal excursion of the right leaf of the diaphragm which becomes elevated This causes a reduction in ventilatory capacity Unless this is detected by the anesthetist at the time and is compensated for by positive pressure through an endotracheal tube the right diaphragm may remain elevated In patients with a diminished cardiorespiratory reserve, this loss of aeration by the right lung may result in a rapid pulse and difficulty in breathing This is a definite indication for the administration of oxygen in the recovery room A differential diagnosis between this condition and collapse of the right lung by spontaneous pneumothorax must be made The administration of oxygen is effective in combating the hypoxia and allows the elimination of carbon dioxide These two

Post-Mastectomy

The major problems immediately following this operation are usually related to the bulky dressings which are customarily applied and encircle the chest. Interference with respiratory excursions may occur if the dressing has been applied too snugly. The vital signs are most helpful in the detection of this undesirable situation. A rapid respiratory rate with an increasing pulse rate is an indication that the thoracic cage is too tightly encased. Cyanosis and hypotension are latent danger signs. In such cases, tachycardia and tachypnea are indications for the recovery room nurse to call one of the doctors. Loosening of dressings in mastectomy patients must be accomplished properly, particularly in the presence of skin grafts. Often division of the lower portion of the dressing on the contralateral side, in reference to the operative site, will permit expansion of the lower thoracic cage and alleviation of respiratory distress. These bulky dressings may also encroach upon the axillary contents and interfere with the circulation to the upper extremity. Those who attend these patients must observe the arm and hand for cyanosis or pallor, and must palpate the radial pulse at intervals on the operative side. In most cases, pulse can be restored and color improved by abduction of the arm. The responsible physician must be notified if there is evidence of impaired circulation to the arm.

Shock due to blood loss at the time of operation may occur in the recovery room in these patients if the blood replacement at the time of operation was insufficient. Pallor, tachycardia, and hypotension are the usual signs of this imbalance. Bleeding from the operative site is most unusual. Pneumothorax is a potential complication of radical mastectomy but it is fortunately an unusual occurrence. It should be detected at the time of operation, but the signs may not be manifest until the patient is in the recovery room. The picture is somewhat confused by the large thoracic dressing of these patients, but the signs and symptoms are those that have been mentioned in the preceding section. Treatment is by aspiration of the pleural cavity.

Biliary Tract

Many patients who are subjected to cholecystectomy for gallstone disease are in the age group in which degenerative diseases are com

The problems associated with total gastrectomy in the recovery room are related largely to the magnitude of the procedure Many of these operations are accomplished through a thoracico abdominal incision The blood loss is often greater during total gastrectomy than with partial resection of the stomach and particular attention must be given to respiratory function The problems of management of patients who have been subjected to a thoracotomy will be discussed in Chapter VII, and the principles apply to these patients who have had entry into the thorax

Colon and Rectal Surgery

Resection of the rectum by a combined abdominoperineal operation is a procedure of considerable magnitude Blood loss at the time of operation may often be extensive Assessment of the circulatory status of these patients upon arriving in the recovery room is of utmost importance Frequently the last stage of the operation is performed with the patient in a lithotomy position, and hypotension not infrequently develops when the patient is returned to a flat, supine position Adequate transfusion is mandatory

Because of the proximity of the operation to the lower urinary tract, these patients require an indwelling catheter The catheter usually a Foley bag catheter should be attached promptly to a bottle for the collection of the urinary output The character of the urine is of importance as well as the volume The urine is frequently blood tinged, and this must be noted

The pelvic floor and perineum may be closed about several drains or a pack may be inserted into the pelvic cavity from the perineal aspect at the time of operation The character of the drainage from the perineal wound must be observed and any unusual amount of bleeding must be inspected by a responsible physician Postoperative hemorrhage although not common, is occasionally encountered In addition excess exudation from the perineal wound may be a sign of injury to some part of the urinary tract at the time of operation

The principal serious complications of resection of the large intestine other than the general problems to which all surgical patients are subject, are related to intra-abdominal difficulties In the immediate postoperative period intraperitoneal bleeding is a cause of shock in a few patients

Probably the most frequently performed rectal operation is hemor-

complications are also prevalent among patients who have been subjected to common duct exploration or choledochotomy

In addition, most patients, following exploration of the common duct have T tubes or common duct catheters, protruding from their dressings, which must be attached to drainage It is important that such tubes be attached securely to the patient s skin and dressing so that they will not become dislodged during restless movements or turning that may occur in the immediate postoperative period The volume of biliary drainage should be measured and recorded In addition many patients following cholecystectomy and other operations upon the biliary tract will have nasogastric tubes which require attention while the patient is in the recovery room This will be discussed later in this chapter

Post Gastrectomy

The magnitude of gastric operations is greater than most of the preceding surgical procedures discussed thus far Management of respiratory and circulatory aspects of care becomes of greater importance Because some of these patients, for example after plication of perforated ulcers, are subject to major electrolyte and fluid imbalance, it is of utmost importance that an accurate record be maintained of all fluid therapy and fluid loss whether by gastric suction or by urine

A complication that may be expected in some patients following gastroenterostomy or gastric resection is bleeding from the suture line While the appearance of some fresh blood and, more often, dark bloody drainage from the nasogastric tube is not unusual the persistence of fresh blood in the gastric drainage should suggest the possibility of this complication When persistent bloody gastric drainage appears the volume should be determined at frequent intervals This is an indication for the recovery room nurse to notify the doctor A transfusion should be given if symptoms of blood loss occur Fortunately in many instances bleeding from the suture line will cease spontaneously within a few hours The volume of blood lost by the gastric tube is at times an unreliable index to the degree of bleeding from the anastomosis This should be suspected if the patient develops nausea and vomiting which cannot be controlled by the gastric tube or if the patient develops hiccups both of which may result from distension of the stomach by retained clotted blood

and discomfort to the patient The failure of the tubes to function may be due to several causes The tubes may be improperly placed so that the orifice of the tube is in the esophagus rather than in the stomach The holes in the distal end of the tube may be occluded by *blood clots, secretions, or adherence to the mucosa of the stomach*

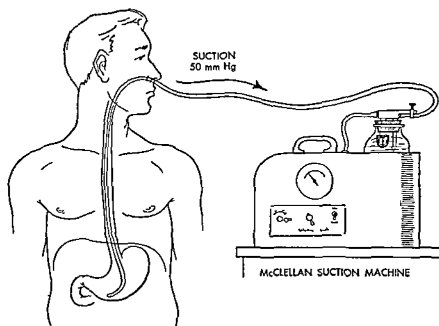


FIGURE 8 The diagram of gastric suction demonstrates the nasogastric tube in the dependent portion of the stomach and connected to an appropriate suction devise in this instance a McClellan suction machine

Gentle manipulation of the tube and irrigation with small quantities of sterile saline will solve the latter problem Many nasogastric tubes have markers at a point that should be at the level of the nostril Because this is an average distance, it cannot be relied upon The tube may be of improper length for some individuals and it may also curl within the esophagus If the tube does not function after irrigation with 30 ml of saline it should be adjusted by a physician The physician should be promptly notified if the patient has persistent vomiting about the tube

Double lumen tubes of greater length are sometimes employed to decompress the intestinal tract distal to the duodenum One end of these tubes is connected to a balloon which must be inflated by the physician The other is connected to the *suction* apparatus as with the nasogastric tube (Figure 9) These tubes are from 6 to 8 ft in

rhoidectomy The most important complication of hemorrhoidectomy is hemorrhage from the operative site This may occur and be of sufficient magnitude that transfusion and ligation of the bleeding point may be required For this reason, the operative site must be inspected for evidence of bleeding at frequent intervals

Splenectomy

The chief postoperative complication of splenectomy that is encountered in the operating room is intraperitoneal, intra abdominal hemorrhage Insertion of drains into the left upper quadrant is frequently employed at the time of this operation, and it is important to inspect the dressings frequently for evidence of bleeding The signs of bleeding from the splenic pedicle are those associated with blood loss and shock

General Considerations

It is apparent from the preceding remarks that there are many potential complications that may occur in the period immediately following operation Careful supervision by those who are responsible for recovery room care is mandatory An alert attitude must be maintained by the staff at all times so that problems can be met at the time of their inception It is important that the nurse in charge of these postoperative patients learn to notify the responsible physician when danger signals are apparent It is also imperative that the necessary equipment be immediately available for the physician when he responds to a call Attention to details is worthy of emphasis

Intestinal Intubation

Various types of gastrointestinal tubes are frequently employed following surgical procedures The most commonly employed is the nasogastric tube which is inserted through the nasal pharynx into the stomach The purpose of this tube is to aspirate secretions and air from the stomach Acute gastric dilatation has become uncommon because of the frequent use of such tubes in many operations These tubes are connected to some type of suction apparatus and a negative pressure of 50–60 mm of mercury is sufficient (Figure 8) If these tubes are not functioning properly in the period of recovery from anesthesia vomiting about the tubes may ensue, with retching

CHAPTER VII

Care of the Patient following Thoracotomy

WARD D O'SULLIVAN, M D

The maintenance of a patent airway and attention to the tracheo bronchial tree are of utmost importance in patients who have been subjected to thoracotomy Free exchange of air in such patients through the respiratory passages is frequently complicated by splinting of the chest from incisional pain, partial collapse or removal of the lung, and pulmonary disease in addition to the usual problems which face other patients in the postoperative period

In the approach to these problems it is well to remember that the thorax is a structure with rigid walls and a limited capacity The addition of either air or fluid in the pleural space results in some degree of collapse of the lung The fundamental mechanism of exchange of air in the lungs depends upon the expansion of the rib cage and the descent of the diaphragm The negative pressure thus created draws atmospheric air into the lungs through the tracheo bronchial tree Lack of expansion or diaphragmatic movement results in a smaller ventilatory exchange and hence may contribute to hypoxia Furthermore if an opening is present through the chest wall into the pleural cavity air will enter as readily through such an aperture as through the trachea and lead to pneumothorax Because such air does not have as ready exit as entry, the pneumothorax will increase and a tension pneumothorax will develop unless the opening is closed Thus the goal in care of these patients is to maintain maximum ventilatory capacity by means of a patent airway, good lung expansion and adequate expansion of the thorax

General Considerations

Upon the arrival of the patient in the recovery room the nurse must ascertain several details in addition to the determination of

length and must be carefully manipulated if they are not to be withdrawn inadvertently by the attendants or by the patient It is important that the proper lumen be connected to suction

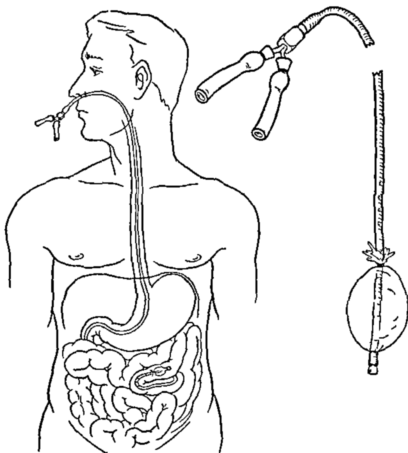


FIGURE 9 The double lumen tube is designed to decompress the small intestine The suction lumen must be identified before insertion and distinguished from the lumen that leads to the balloon

Catheters or T tubes may be placed in the common bile duct These tubes should be connected to drainage bottles without suction Catheters or decompressing tubes, which may be placed in ileostomies and colostomies at the time of operation should be attached to drainage according to the directions of the surgeon Any tube that is protruding from an orifice when the patient returns from the operating room must be carefully managed according to the directions given in the doctor s orders Clamps must be removed from tubes only according to specific directions The drainage from all tubes and catheters must be accurately measured and recorded on the patient s record

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WARD D OSULLIVAN, M D

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vital signs and color It is imperative that the character of respiratory exchange be noted and that the location of the incision and presence or absence of tube or tubes from the pleural cavity be determined If an endotracheal tube is still in place tracheobronchial suction must be accomplished by the anesthetist prior to removal The endotracheal tube must be removed only by a physician A physician must be notified at once if evidence of obstruction to respiration appears This is particularly critical in small children who are prone to develop subglottic edema after prolonged endotracheal anesthesia

Copious bronchial secretions are frequently troublesome after thoracic operations, especially following pulmonary resection Frequent aspirations of the pharynx are required and tracheal aspiration is necessary at times Rapid respiratory excursions cyanosis, and tachycardia may indicate a mucous plug in one of the major bronchi Conscious patients must be encouraged to breathe deeply and cough in an effort to evacuate the lower respiratory tract of secretions Tracheal suction and even bronchoscopic aspiration may be required to remove tenacious plugs in occasional instances Inhalation of detergents (e g Alevaire) has been found useful in liquefying troublesome secretions in those who are not relieved by the customary methods

Proper position is important in the care of patients after thoracic operations In general patients who have been subjected to pulmonary resection should lie on the back or upon the operative side thus assisting drainage from the opposite side This is less significant after esophageal or cardiac surgical procedures

Restlessness of the patient is not infrequently encountered in the recovery phase after thoracic operations This may be an indication of hypoxia rather than of pain and for this reason narcotics must be used with caution in the restless postoperative patient The administration of oxygen by tent or mask will frequently relieve restless states more effectively than the administration of narcotics which may increase hypoxia by respiratory depression

Frequent examination of the patient by a physician is imperative in the management of patients after thoracic operations This examination should include inspection of skin color and mucous membranes, pulse rate, rhythm and character and respiratory rate and character Evidence of obstruction of the respiratory passage may

be indicated by suprasternal retraction and stertorous breathing The trachea should be felt for deviation from its normal midline position The chest wall and neck may be quickly palpated for evidence of subcutaneous emphysema

Percussion and auscultation should disclose evidence of pneumothorax and inadequate expansion if present In our experience a chest plate in the immediate postoperative period has proven to be so valuable that it is now ordered on almost all patients after thoracotomy A satisfactory portable chest x ray will determine the adequacy of lung expansion and the presence of significant pneumothorax or mediastinal emphysema

Parenteral fluids should be administered with caution It is im portant to remember that many of these patients are elderly with reduced pulmonary and cardiac function Excessive infusion or intravenous fluids can readily produce cardiac decompensation and pul monary edema in patients who have been subjected to pneumonec tomy or cardiac surgery While blood loss must be replaced by transfusion, parenteral fluids must be injected slowly and in quantities that supply metabolic needs Basilar rales venous engorge ment, and cardiac irregularity may indicate hypervolemia which can best be relieved by phlebotomy

In these patients, close cooperation between the nursing staff the surgeon, and anesthesiologist can contribute significantly to smooth convalescence for difficult problems The anesthesiologists have invaluable experience and knowledge of pulmonary function and physiology which are of great importance in the management of thoracic surgical patients

Specific Problems

Pulmonary Resection The general nursing problems in regard to maintenance of an adequate airway have already been outlined The nursing care is complicated by the presence of one or two catheters protruding from the pleural cavity in many of these patients These catheters must be connected to proper water traps or suction, ac cording to the surgeon s orders Care must be taken to assure patency of the tubing and to see that the tubing is not kinked or obstructed by movements, or position, of the patient In patients after pulmonary lobectomy a catheter may project from the anterior aspect of the chest from the second or third interspace another from a lower

interspace in the axillary line Sterile tubing should be attached to the catheter and to the proper receptacle before the occluding clamp is removed from the catheter

In many instances the tubing attached to the pleural catheter, is connected with a glass tube placed in a bottle under water If an intrapleural tube were allowed to exit from the chest without taking this precaution it would serve as a portal of entry for air rather than as an exit for fluid With the water trap, a few centimeters of water will rise in the tube thereby satisfying the negative pressure in the pleural cavity In a properly functioning drainage tube one can observe a small rise and fall of the level of water in the tube as the patient breathes To serve its function as a drain, the tube must be placed just beneath the surface of the water If the end of the tube is placed too deeply, the fluid that is to be drained from the pleura must push its way through a deep column of water to escape

In some cases, drainage by means of a water trap may be inadequate and, accordingly suction may be applied To prevent excessive suction *a bottle is placed between the source of suction and the* collecting bottle This interposed second bottle regulates the amount of suction transmitted to the drain by a safety tube placed under water (Figure 10) The regulating bottle has a stopper with three holes in it One hole is connected to the source of suction one to the patient s drainage bottle, and one to a tube opening into room air

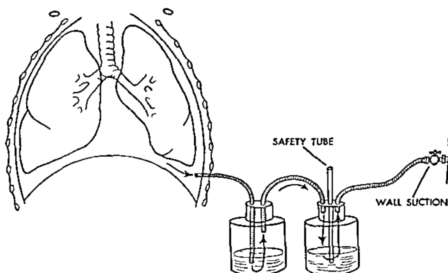


FIGURE 10 Diagram of underwater suction indicates the principle of pleural drainage The tube which drains *the pleural cavity extends below the water level*

Inside the bottle, this last tube descends 10–12 cm beneath a water column level, thus creating the safety valve If the suction goes higher than 12 cm of water, air is drawn through this glass tube and can be seen bubbling through water Thus the effective suction that is transmitted to the pleural drainage tube is less than 12 cm of water which is a safe and effective amount of suction

Recently a machine has been developed which provides safe, constant, and effective suction and has been designed for pleural aspiration The apparatus, known as a Seal O Meter, has the additional advantage of compactness which is frequently pertinent in an active recovery unit

An extremely serious complication of pulmonary resection, which is encountered immediately following operation is hemorrhage into the pleural cavity from one of the pulmonary vessels This catastrophe is heralded by the rapid development of shock and bloody pleural drainage when a tube is in place The patient s life can be saved only if prompt exploration of the thorax is carried out in the operating room and the bleeding point ligated

Some degree of subcutaneous emphysema may be detected about thoracotomy incisions This is usually limited in extent but if it progresses, it is an indication of the escape of air from pulmonary tissue or from the tracheobronchial tree and that the air is not gaining proper egress through the pleural drainage tube If subcutaneous emphysema is detected its extent should be carefully noted and the progress followed at frequent intervals The drainage catheters or tubes should be checked for function If functioning properly as regards patency, suction will usually be of benefit A firmly applied dressing to the incision will be of benefit for small local extravasation of air

Surgery of the Heart and Great Vessels In many of the patients subjected to cardiac surgery the problems that are common to thoracic operations are compounded by an underlying defective myocardium It is essential that these patients are provided with adequate oxygenation For this reason most are placed in an oxygen tent or receive oxygen by mask upon their arrival in the recovery room Opiates are kept at a minimum in an effort to prevent respiratory depression and consequent hypoxia

The nurse must keep the pharynx free from secretion and must carefully record the pulse rate rhythm, and character at frequent

intervals Pulse irregularities must be called to the attention of the responsible physician immediately It is to be recalled that many of the patients who have been subjected to mitral commissurotomy (valvulotomy) have atrial fibrillation and that the pulse deficit must be recorded by taking an apical and radial pulse rate Facilities for portable electrocardiograms are most desirable in the management of these patients in the recovery room

Cardiac tamponade is a complication to be considered in patients undergoing cardiac surgery The development of hypotension narrow pulse pressure with a rising diastolic pressure, tachycardia, and distended neck veins indicate cardiac tamponade Pericardiocentesis will confirm the diagnosis in most instances in the immediate postoperative period

The keynote to satisfactory management of the patients after cardiac surgery is frequent examination by one of the members of the operating team Frequent auscultation may lead to the early detection of basilar rales which may indicate early pulmonary edema Pneumothorax mediastinal shift and inadequate expansion of the lungs must be sought for both by physical examination and by portable x ray examination of the chest

Other Thoracic Operations Operations upon the esophagus, mediastinum and chest wall share the problems of respiratory exchange already discussed Some of these are time consuming operative procedures and the recovery phase may be prolonged with depressed respirations and evidence of blood loss The major complications are related to poor lung volume and expansion as well as to pneumothorax Intrathoracic bleeding may occur and the magnitude may not be accurately reflected by the pleural drainage if clotting occurs In mediastinal surgery and esophageal operations the possibility of pneumothorax on the side opposite the operative approach must be borne in mind The contralateral pleural cavity is easily entered and may not be detected at the time of operation If such is suspected from physical examination aspiration of the pleural space should be performed It is important to examine such patients repeatedly for the possible reaccumulation of air following aspiration

CHAPTER VIII

Care of the Neurosurgical Patient

R A CLARK JR, M D, and H PARSONS, M D

With the increasing variety of neurosurgical procedures carried out in the operating room, there is a corresponding diversity in cases which are returned to the recovery room Each of them will differ in the immediate postoperative period and for this reason will require some understanding of their basic problems

In the past local anesthesia was used for many of the operations In recent years general anesthesia is being used almost exclusively for the longer procedures Thiopental (Pentothal), nitrous oxide-oxygen, and ether are the agents most commonly used and, lately, these general anesthetics are often supplemented by hypotensive drugs such as trimethaphan (Arfonad) to reduce bleeding during the operation A smaller amount of general anesthetic is needed, usually, when used in conjunction with a hypotensive drug Accordingly patients may be expected to regain consciousness more promptly after operation than formerly The amount of blood given by transfusion during operation has been reduced materially by the use of such agents

Intracranial Operations and Injuries

The most important problem that presents itself when the unconscious patient arrives in the recovery room concerns the patient s respirations Does he have a clear airway? Is his breathing even and regular? Obstruction to the patient s airway will cause him to strain and to increase his venous pressure this in turn will result in not only venous bleeding at the site of operation but will result immediately in increased intracranial pressure At the end of the operation it is alarming to the operator to see his patient who is already reacting

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respects Aphasia must be differentiated from unconsciousness Much can be learned from the way the patient resists attempts to move him or how he resists unpleasant stimulation, such as suctioning Observation of the pupils should be made To be noted particularly is whether they are unequal or whether one pupil is becoming more dilated than the other, progressively If the patient develops convulsions these should be noted carefully, with particular reference to which part of the body they start, their progression, and whether there is any obvious paralysis following the convulsion An effort should be made to prevent the patient from biting his tongue during a convulsion by inserting a gag, an airway, or a firm object between his teeth The development of a decerebrate state (an ominous sign manifested by extensor rigidity of the lower extremities and extension and internal rotation of the arms) is to be differentiated from convulsions

In observing the vital signs, the respirations are of particular importance The development of Cheyne Stokes or intermittent respirations may indicate increasing intracranial pressure A rapidly rising blood pressure with slowing of the pulse and respirations sometimes accompanies increasing intracranial pressure from whatever cause The rise in blood pressure is not necessarily significant unless it is higher than the preoperative level The preoperative level should be checked with this in mind A change of less than 20 or 30 mm of mercury is not necessarily of significance

Any important change in the vital signs, regression in the state of consciousness or strength of the extremities or persistent pupillary inequality is indication to call the surgeon Severe headaches and protracted vomiting increasing restlessness, and undue elevation of temperature may accompany increasing intracranial pressure The surgeon wants to be informed if these symptoms and signs exist

Usually postoperative head pain can be controlled satisfactorily by codeine or aspirin In general, one tries to avoid using morphine in patients with intracranial lesions because it interferes with the observations of the state of consciousness may increase intracranial pressure and depress further the already depressed respiratory center Restlessness is most commonly due to either a full bladder or pain The bladder should be checked by palpation and percussion, and catheterization should be resorted to if necessary Pain can be

begin to cough and strain spontaneously or as the result of extuba tion He imagines that the numerous veins he has been struggling to occlude are opening each time the patient strains As the anesthe tized patient reacts he coughs with the slightest movement of the intratracheal tube If it becomes evident that the patient is going to react, the tube should be removed as soon as possible and substituted with a mouth or nasal airway, which must be kept clear and clean at all times Often this can be aided by proper positioning of the patient Judicious suctioning of the patient may be necessary If the suction tube is inserted far down into the trachea to reach the carina the bifurcation of the trachea and the major bronchi, the patient may begin to cough and strain This may be desirable if it is not persisted in too long

Following intracranial operations, the position of the patient in the immediate postoperative period is of the greatest importance While still unconscious it is safest to keep the patient flat in bed with his head and body turned well to one side to obtain adequate drainage of the respiratory passages The position should be changed frequently from side to side and at least every hour or two Once the patient has recovered sufficiently to cough spontaneously and to prevent his tongue from falling backward moderate elevation of the head will promote better drainage of the cerebral veins It has been our policy therefore, to keep the patient flat in bed on either side until reacted, then to elevate the head 20 deg above the horizontal It may be desirable to keep the head elevated from the beginning for special reasons or if the patient s blood pressure is very low, it may be desirable to keep him flat Posterior fossa cases are usually kept flat for the first few days and then when they are turned they are turned rigidly as one piece without flexion

The patient should be observed carefully for evidence of post operative hemorrhage or rapidly increasing intracranial pressure Normally the state of the patient s consciousness should improve steadily At first, the patient will respond to painful stimulation or discomfort, and later will respond to the spoken voice with move ments of the extremities or eyes at first and then by speaking Spon taneous movements should be observed carefully as to whether there is weakness or paralysis of one extremity or one side If the patient cannot speak it is important to note whether he is alert in other

Gauze and adhesive dressings are used in posterior fossa cases with adhesive strips running down from the head over the back in check rein fashion to prevent accidental flexion of the neck when the patient is turned or when he changes position spontaneously as he is reacting from anesthesia Such patients should be moved in one piece' so that the head and trunk are not twisted separately in the process of being turned

Air Studies

Ventriculograms for the most part are done under local procaine anesthesia, but occasionally general anesthesia will be used for a restless or uncooperative patient If a definite abnormality is found in the air studies, craniotomy will be performed promptly If the x rays are negative no further procedure is done and the patient will be transferred to the recovery room It is expected that he will return to his preoperative state in a short time When this does not occur the staff should be notified

Arteriograms

Most carotid arteriograms are done by direct injection through the skin of the neck into the common carotid artery This is usually a brief and relatively simple procedure Although local anesthesia may be used in some cases in most instances they are done under general anesthesia At times the iodine containing material (acetrizoate [Urokon] or iodopyracet [Diodrast]) may extravasate into the tissues adjacent to the artery At other times bleeding may be excessive after the needle is withdrawn In either instance undue swelling of the neck should be looked for promptly upon the patient s arrival in the recovery room Direct pressure and gentle massage over the site of injection usually stops the bleeding An ice collar is comforting and may help prevent edema When swelling is excessive the trachea is displaced or compressed, and the respirations may become obstructed The swelling of the neck should be observed at frequent and regular intervals A tracheotomy set should be near in case it should be needed

Under special circumstances arteriograms are done by exposing the artery through an incision in the neck before making the injection The same observations and precautions are necessary in such cases This applies to other neurosurgical procedures done in the

alleviated then by suitable analgesics If, in spite of these measures restlessness persists side boards or gentle restraints, such as sheet wadding and stockinette boxing gloves, may be necessary

At times dressings may be changed in the recovery room In some instances a catheter may have been inserted into one of the lateral ventricles for purposes of decompression, particularly following posterior fossa operations This catheter is sutured to the scalp margin attached to the dressing with adhesive, and passed out through the main dressing In some instances the catheter will be clamped The clamp will have to be released intermittently under sterile precautions to allow for release of ventricular fluid In other instances it will be open but allowed to drain into some sort of sterile rubber container which, in turn will have to be emptied at intervals In still other cases where no catheter has been inserted, ventricular taps may have to be done by inserting a ventricular needle through a bur hole (usually in the posterior parietal region) to remove ventricular fluid when there are indications that intracranial pressure is rising Occasionally lumbar puncture may be used for similar reasons Appropriate ventricular or lumbar puncture needles and setups for puncture should be kept on hand

When a postoperative clot is suspected (because of signs of increasing intracranial pressure because of development of a progressive unilateral paralysis opposite to the operative site or because of dilatation of the homolateral pupil) it is necessary to return the patient to the operating room reopen the wound, and evacuate the clot or remove the bone plate to allow for greater decompression This will be done more expeditiously if this eventuality is considered beforehand The operating room staff should be forewarned if this possibility seems imminent

Dressings vary depending on the nature of the operation Simple cotton and collodion dressings are used for ventriculograms and some neck operations such as open arteriograms or ligations of the carotid arteries Gauze neurological roll (compress) and crinoline (or Elastoplast) dressings are used for most cerebral craniotomies In this regard if moist starched crinoline dressings are used, it is mandatory to dry them immediately in the postoperative period usually with the aid of a hair dryer Special care should be taken never to leave the dryer running unattended because of the danger of burning an exposed area of skin with the hot air of the blower

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neck (excision of a cervical rib, scalenotomy, cervical or upper thoracic sympathectomies).

Carotid Ligations

Ligation of either the common carotid or internal carotid arteries in the neck deserves more detailed comment. This is done under local anesthesia so that the patient can be kept under careful neurological observation at all times. This procedure is done, usually as a preliminary step in the treatment of vascular intracranial lesions, such as aneurysms or arteriovenous anomalies. In such cases, the development of weakness of the extremities on the side opposite the ligation, the development of an extensor plantar response on the contralateral side, the development of aphasia, or the deterioration of consciousness should be tested for at frequent, regular intervals and be reported immediately. Under such circumstances it will be necessary to loosen or remove the ligatures without delay if permanent neurologic deficit is to be avoided.

Peripheral Nerves

Operations on various peripheral nerves require little special postoperative care. For the most part, these operations consist of careful dissections of the nerves, the resection of neuromas at the divided ends of the nerves, and anastomosis of the nerve endings. In many instances there will be a gap in the nerve which is compensated for by placing the involved extremity in such a position that the ends of the nerves can be brought together without tension. This position is maintained by splinting the extremity with a plaster splint or cast. *Postoperatively the involved extremity should be kept elevated to prevent edema.* The extremity should be checked at frequent intervals to see that there is no undue edema, pallor, or cyanosis of the digits. Morphine may be used for relief of pain. If the cast seems to be too tight, it may have to be split, revised, or removed and reapplied.

Sympathectomies

Thoracolumbar sympathectomies which are performed for hypertension are done, usually, in two stages. Of particular concern is the presence of a pneumothorax which may result from opening the pleura in the course of the operation. Any residual pneumothorax is

usually sucked out when the wound is closed A portable x-ray of the chest is taken in the recovery room to be certain that re expansion of the lung is complete If there is sufficient residual pneumothorax to cause respiratory embarrassment, the air should be aspirated, but this is rarely required

Following the first stage there is little change in the blood pres sure Following the second stage however, or when both sides are done at the same time, there may be a marked drop in blood pres sure Under such circumstances, if the pulse remains slow, it does not signify that anything is amiss Even so if the systolic pressure drops below 80–90 an effort should be made to overcome this low pressure The patient can be placed in shock position and a tight abdominal binder, which does not interfere with respirations and elastic bandages should be applied to the extremities One or more transfusions are given during the second stage If these measures are still not adequate to overcome the fall in pressure, phenylephrine (Neo synephrine) can be given in an infusion by intravenous drip Postoperative pain is moderately severe but is usually controlled satisfactorily with morphine

Laminectomies

The management of laminectomies varies depending on the na ture of the lesion and its location When a herniated disc in the lumbar region has been removed little or no special care is needed other than usual postoperative measures It is not necessary for such cases to be kept off their backs unless a spinal fusion has been done Most laminectomy patients are kept flat in bed and may be turned from side to back to side as long as the spinal axis is kept in a straight line Voluntary movement of the extremities should be checked at frequent intervals and any sudden drop in blood pressure should be reported In any case in which a cervical laminectomy has been performed the neck should not be twisted or moved suddenly, for fear of injuring the cervical cord In some cases where there is a serious amount of cord compression or myelitis and following all chordotomies marked weakness of the legs and loss of pain sensation in the lower trunk and legs are to be expected Such patients are prone to develop pressure sores if they lie in one position longer than an hour or two An alternating air mattress will help to prevent such decubiti and these patients should be turned frequently (at least

neck (excision of a cervical rib, scalenotomy, cervical or upper thoracic sympathectomies)

Carotid Ligations

Ligation of either the common carotid or internal carotid arteries in the neck deserves more detailed comment This is done under local anesthesia so that the patient can be kept under careful neurological observation at all times This procedure is done, usually as a preliminary step in the treatment of vascular intracranial lesions such as aneurysms or arteriovenous anomalies In such cases, the development of weakness of the extremities on the side opposite the ligation the development of an extensor plantar response on the contralateral side the development of aphasia, or the deterioration of consciousness should be tested for at frequent, regular intervals and be reported immediately Under such circumstances it will be necessary to loosen or remove the ligatures without delay if permanent neurologic deficit is to be avoided

Peripheral Nerves

Operations on various peripheral nerves require little special postoperative care For the most part these operations consist of careful dissections of the nerves the resection of neuromas at the divided ends of the nerves and anastomosis of the nerve endings In many instances there will be a gap in the nerve which is compensated for by placing the involved extremity in such a position that the ends of the nerves can be brought together without tension This position is maintained by splinting the extremity with a plaster splint or cast *Postoperatively the involved extremity should be kept elevated to prevent edema* The extremity should be checked at frequent intervals to see that there is no undue edema pallor or cyanosis of the digits Morphine may be used for relief of pain If the cast seems to be too tight, it may have to be split revised or removed and reapplied

Sympathectomies

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CHAPTER IX

Care of the Ophthalmological Patient

STUART S SNYDER M D

The number of eye patients that require care in the recovery room is relatively small Most ocular surgery is performed under local anesthesia Exceptions are infants and children with congenital cataract, ptosis, strabismus, or traumatic injuries who require general anesthesia (Patients under the age of 3 years usually receive vinyl ether [Vinethene] induction and are carried through the procedure with ether Children over the age of 3 years usually receive rectal thiopental [Pentothal] induction in their rooms and are carried upon a closed system of ether) In certain adult eye operations (enucleations, surgery for retinal detachment intraocular biopsies, plastic and traumatic procedures), intravenous thiopental (Pentothal) is preferred by the surgeon

Following some procedures, one eye is covered with a patch while in others both eyes are covered It is more difficult to handle the patient who has both eyes patched These patients require close attention as they are returning to consciousness If nausea or vomiting is present, it should be relieved or controlled at once, especially if it follows an intraocular operation Dimenhydrinate (Dramamine) or chlorpromazine (Thorazine) may help to control nausea and vomiting

Head movements should be kept at an absolute minimum This can be done by talking to the patient and gently holding his head If disorientation or restlessness is present further sedation is needed It is necessary to restrain the hand movements of children by using elbow splints as in this way the child can move his arms but cannot remove his bandages

In adults pain can be controlled with codeine or meperidine

every two hours) Care should be taken to see that the bed linen is kept dry at all times Hot water bottles should not be used lest these patients be burned inadvertently, as they are not able to appreciate the sensation of heat If the heels and ankles are padded, pressure sores in these areas will usually be prevented At times particularly in the chordotomies, there may be a marked drop in blood pressure similar to that seen in the second stage sympathectomies This is due to interruption of the sympathetic pathways in the spinal cord and can be dealt with in the same way as in the sympathectomy patients (by Trendelenburg position, abdominal binders, elastic bandages on the extremities transfusions and intravenous infusions of phenylephrine [Neo synephrine])

CHAPTER X

Care of the Plastic Surgical Patient

RICHARD B STARK, M D

Plastic surgery patients who will be sent to the recovery room can be divided into those with traumatic injuries and post traumatic repair those with hand problems, those with congenital defects, those for head and neck surgery with reconstruction those with cosmetic defects, and those with decubitus ulcers

The Patient with Traumatic Injuries

Plastic surgical operations entail meticulous craftsmanship in the operating room which can be undone easily by careless handling of the patient and his wounds in the recovery room

In general, fractures of the facial bones involve depressed deformities which require elevation or repositioning The patient returning to the recovery room following an elevation of fragments of facial bones must be prevented from traumatizing the corrected area during his recovery period Fractures of the zygomatic arch require elevation usually through a temporal incision The bony fragments will usually stay in their new position, but the patient must be prevented from lying upon that area Displacement of the nasal bones can be repositioned within several days following injury, and a protective dorsonasal splint will be applied so that the new position will not be lost inadvertently Fracture of the middle third of the face or of the mandible is usually splinted by wiring the teeth in occlusion if the patient has an adequate complement of teeth, and applying a Barton bandage The intact jaw is utilized to splint the jaw which is injured This can be done simply by applying wire loops around the neck of the teeth When the patient returns to the recovery room, the jaws should not be approximated by rubber ban

(Demerol) by subcutaneous injections Pain in children is rare but can be relieved by appropriate doses of these drugs

Coughing must be controlled immediately following intraocular operations If nausea and vomiting occur, codeine phosphate or one of the other central depressants can be administered subcutaneously Alleviation of tension and nervous strain can be done vocally, but occasionally mild sedation is necessary

Before the patient enters the hospital, it is important that the surgeon explain the usual preoperative and postoperative care These explanations give the patient an understanding of what to expect, and thus his fears are allayed, and complications are reduced

If the eye patches are removed inadvertently during the recovery period they should be replaced immediately, and the surgeon should be informed

Bleeding or excessive discharge should be reported to the surgeon, but no treatment should be started until he examines the patient

A patient should be in his own bed in the recovery room so that as soon as he has reacted fully he can be returned to his room without unnecessary movement It is better to keep patients overly long in the recovery room rather than not long enough

Postoperative dehydration of the ophthalmological patient is unusual, and intravenous infusions are rarely needed These infusions are started before or during surgery The recovery room nurse need only be certain that it continues to flow normally

Special care is required for cases of retinal separation These patients must be kept absolutely quiet as they are emerging from the anesthesia They should be flat on their backs and the head should remain stationary Nausea vomiting coughing and restlessness have to be regulated at once if they appear It is very important to talk gently to these cases and to reassure them repeatedly

The touch of the nurse s hand and soothing words restore confidence

Gentle, kind sympathetic care plus restriction of movement of the head will prevent most if not all postoperative complications in the recovery room

block of tissue nourished by this pedicle is the pedicled flap. Following transplantation to a new site, the circulation to a pedicled flap is marginal. It can be obliterated completely if the pedicle, through which the circulation flows, is stretched so that the walls of the blood vessels are coapted or if the pedicle is kinked. The tip of the pedicle must be observed frequently. If it is pale and cold, the arterial circulation has been occluded. If the tip is cyanotic and blue, the return of venous circulation is impaired. The surgeon should be called if either of these situations prevail. The kinking or stretching of the pedicle must be corrected by changing the position of the parts affected. Occasionally an oscillating bed must be used so that the blood can be moved into and out of the pedicle alternately by gravitation.

The recovery room care of *burns* revolves itself about the care of the patients who have returned from the operating room following a debridement of slough resulting from third degree burns, the application of organic acids or of enzymes to hasten the separation of this slough, or following the surfacing of granulating wounds which have resulted from burns with thick-split grafts of skin. In the case of the patient who has had a debridement of burn slough the dressings must be watched for evidence of fresh bleeding through the dressings. Occasionally the burn wound will be treated with a closed dressing in which are incorporated sterile Dakin's tubes. It is by means of these tubes that the dressings are wet at periodic intervals. Care must be taken to preserve the sterility of the exposed tip of the Dakin's tube. To contaminate the tip is to instill organisms into the open granulating field. It is necessary to use sterile gloves when one is instilling the solution into the Dakin's tubes. The exposed tip of the tube must be covered with sterile gauze between instillations.

Large compressive dressings may be used in addition to the tie over dressings for grafts to the eyelids. These become necessary in burns of the eyelids where there is a loss of skin with eversion of the free margins of the eyelids. Ectropion is corrected by excising the scar, allowing the defect to retract to the maximum dimension, and surfacing this with a patterned free whole thickness graft of skin. During the time the dressing is necessary the patient must be reassured that he has not been blinded by the operation. It is well to have forewarned the patient that an occlusive eye dressing is to be applied. If the patient complains of pain in the eye, the doctor should be notified and the dressing inspected.

until the patient is awake and past the phase of vomiting If the jaws are wired together while the patient is still nauseated, the possibility of aspirating vomitus is real Fractures of the middle third of the face may be elevated by merely packing the antrum or by wire traction attached to a head cap

Fractures of the mandible should be of greater concern to the nurse in the recovery room because the attachment of the tongue has been disrupted, and its backward displacement may impinge upon or occlude, the vital airway Signs of respiratory obstruction must be appreciated An oral airway or traction on the tip of the tongue will reposition the tongue forward If vomiting occurs after the jaws are either wired or held in occlusion by means of rubber bands the wires or the bands should be cut at once and the patient s oral cavity suctioned

The patient with *post traumatic* injuries is treated, in general, by revision of scars and free grafts of tissues of which the largest percentage consists of skin Skin grafts can be either of partial or whole-thickness skin These grafts are anchored into place by the use of interrupted sutures at their margins the tails of which are left long These long tailed sutures are then tied over a bolus type of dressing and, in this way, the graft is immobilized by the pressure dressing which is sutured in place Skin grafts fail for three reasons They can be lost if they are immobilized insufficiently, if a hematoma develops under the graft, or if infection supervenes The first two reasons for failure occur more frequently than does the loss due to infection If the patient struggles unduly in the postoperative period the graft may fail due to excessive mobilization or to the development of a hematoma Minute thrombi may be blown away by a sudden rise in blood pressure, and with the extravasation of blood under the graft a hematoma may result This prevents the graft from lying in close apposition to its bed so that new blood vessels are unable to grow into it to nourish it permanently

Free grafts of cartilage, bone fascia dermal fat and composite grafts (skin fat and cartilage from the auricle of the ear) all must be immobilized absolutely

If more than one tissue is to be transplanted it must be transplanted with part of its blood supply intact (the exception is the composite graft mentioned above which may be transplanted freely) so as to nourish it while it is developing a circulation in its new site The part remaining with circulation intact is the pedicle and the

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Following the correction of a harelip, tension upon the suture line is relieved by using a wicket-shaped metallic arch (Logan bow) which is taped to the cheeks after they have been mobilized toward one another The Logan bow must be maintained in place or the suture line may disrupt when the child cries

The common operations for cleft palate consist of the von Langenbeck operation the V-Y pushback, and the pharyngeal flap

The von Langenbeck procedure closes the cleft by the use of relaxing incisions, made just inside the gum with the mobilization of the mucosa and periosteum toward the midline where they are sutured Occasionally bleeding may be excessive from these relaxing incisions In the V-Y pushback the raw surface is anterior behind the incisor teeth Following a phraygeal flap the raw surface is upon the posterior pharyngeal wall After any of these operations, the patient should be placed face down with the head turned to one side, to facilitate drainage of blood and secretions from the mouth by gravity Suctioning of the oral cavity must be done with extreme caution since additional bleeding or disruption of the operative site may occur Suctioning for any operation upon the palate should be performed along the dorsum of the tongue (Figure 11) Where a pedicled flap of mucous membrane and superior constrictor muscle is taken from the posterior pharyngeal wall and sutured forward to the soft palate in the region of the uvula as in a pharyngeal flap no suctioning should be undertaken via the nasal route because of the possibility of injuring the pedicle

Babies having had these operations should have their arms immobilized in extension with splints made of material which contains sheaths into which wooden tongue blades can be inserted

The cleft palate operation is performed under general anesthesia and constant crying in the immediate postoperative period can occasionally disrupt the wound Sedation is necessary therefore in the immediate postoperative period The patient should be allowed to have clear fluids as soon after the operation as the child is deemed over the period of possible nausea

In cases where there is insufficiency of the upper lip a flap of the entire thickness of the lip can be swung upward from the lower lip leaving the vermilion portion of the lip attached as a pedicle This type of Abbe flap requires that the jaws be immobilized either by wiring or by means of a Barton dressing Usually this procedure is

Extremities may be immobilized in plaster of Paris following the transplantation of a pedicled flap An example is the cross leg flap which is performed through windows in casts which may be applied prior to operation The patient may complain of pain in his joints, and if this becomes severe medication is needed, and the physician should be informed The degree of tension of the pedicle should be appraised frequently Undue tension will manifest itself by causing the pedicle to be either pale or bluish Either situation warrants a call to the surgeon Pedicles which are tubed (in the form of a cylinder) afford a block of tissue for transplantation which is essentially uncontaminated as this block of tissue is closed on its under surface Following the formation of a tubed pedicle, or following its transplantation no tape or constricting dressing should cross the end of the pedicle as they may occlude the blood supply necessary for survival of the pedicle

Care of the Patient following Surgery of the Hand

Most of the patients who have had surgery upon the hand will be immobilized in some type of plaster of Paris cast The color of the digits should be observed cyanosis should be noted and the surgeon must be called if it be present These hands are elevated routinely because dependency will cause venous stasis and will augment pain Operations upon the hand are usually quite painful and will require considerable medication for pain

In surgery of the hand postoperative edema or post traumatic edema is a usual phenomenon This is combated usually by snug pressure dressings and by elevating the extremity above the position of the heart The position of the hand can be maintained upright by a dressing which is attached to an overhead intravenous stand, by means of web strappings slung from the head to the foot of the bed or by elevation upon three pillows The tips of the fingers must always be exposed Circulation may be appraised by depressing the nail in its bed It should blanch with a prompt return of color but if this be not true the doctor should be so advised

Congenital Deformities

The most common congenital deformities corrected by the plastic surgeon are those of harelip and cleft palate Next in frequency are anomalies of the extremities

In some cases in which a hemimandibulectomy has been performed, bone grafting may be done Usually wires have been placed around some of the teeth so that the upper and lower jaws can be immobilized by rubber bands stretched between these wires in the postanesthetic period The patient should reach the recovery room with the jaws open, however After postoperative nausea has subsided, rubber bands are placed between these wires by the surgeon, and the jaws are immobilized by maintaining the teeth in their normal relative position of occlusion

Care of Patients Who Have Had Cosmetic Surgery

Most of the operations for nasal plastic surgery are performed under local anesthesia A large amount of epinephrine (Adrenalin) is added to the anesthetic so that operation can be performed as bloodlessly as possible Because these patients are awake few of them are returned to the recovery room They may be returned if bleeding is excessive and they are maintained in low-Fowler s position so that the blood does not pool in the head and neck a condition which augments bleeding A gauze sponge which will absorb the blood should be held or taped under the nostrils without pressure Usually medication, Fowler s position, and rest will cause the bleeding to cease spontaneously If it does not the doctor should be informed, and additional measures may have to be undertaken in the operating room

Following mammoplasty operations it is imperative that the musculature of the chest wall be kept as immobile as possible This means that the upper arms must be maintained at the patient s sides Excessive activity is detrimental to the surgery recently completed Many of these patients will arrive in the recovery room with a loose bandage about their thorax and upper arms to prevent abduction of the upper extremities

Care of the Patient following Surgery upon a Decubitus

In patients who have had decubiti as a result of paraplegia or of chronic illness a large rotation flap from the adjacent area is swung to surface the area denuded as a result of the pressure sore It is important that their massive pressure dressings not be disturbed or allowed to shift The patient should not lie on the operative site His position should be changed from time to time to those areas which were not involved in surgery

performed under local anesthesia, as it is difficult for a patient who is nauseated to express vomitus when the lips are sewn together This procedure can be performed from the upper lip to the lower in cases of carcinoma of the lip

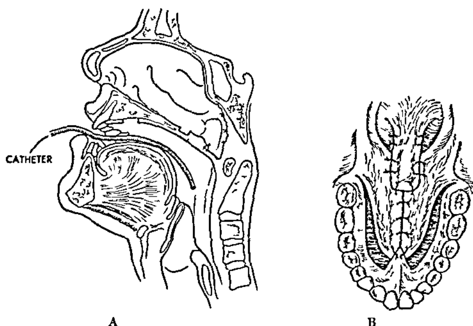


FIGURE 11 *A* shows the position of catheter which must be utilized when suction is performed after a pharyngeal flap is constructed The catheter is inserted along the dorsum of the tongue because of the presence of raw surfaces and sutures which are shown in *B*

Surgical Correction of Carcinoma of the Head and Neck with Its Reconstruction

Following operations for carcinoma of the head and neck, the possibility of bleeding within the mouth per se and of this bleeding precipitating spasm of the vocal cords is a real danger In many operations the musculature of the tongue is detached from the mandible rendering the tongue less stable and more prone to fall backward where it may obstruct the airway For these reasons it is a common procedure following many of these operations to perform a tracheostomy and leave the tube in situ for three or four days to ensure an unobstructed airway The care of such a tracheostomy includes moistening of the air entering the trachea suctioning frequently, cleansing the inner tube and the observing for bleeding or for subcutaneous emphysema (See Chapter XII)

result A fastidious person may be tempted to clamp the drainage lumen until nursing arrangements are made This is unwise and dangerous, since back pressure of urine which results from an obstructed catheter can rupture recently placed sutures, and cause extravasation of urine Infection, fibrosis, and stricture may result, and if the extravasation is massive, death may ensue These tubes should be irrigated only when ordered and then only with solutions compatible with intravenous injection (i e , saline, 5 per cent glucose in water) The possibility of introducing irrigating fluid directly into the vascular system through open prostatic blood vessels is always real, especially following bladder or prostatic surgery Hence, no solution that would be dangerous if introduced into the vascular system (i e , boric acid) should be used

Instruments for irrigating catheters (Figure 13) should be sterile and available in the recovery room These instruments should include several sizes and types of catheters, bulb and plunger-type

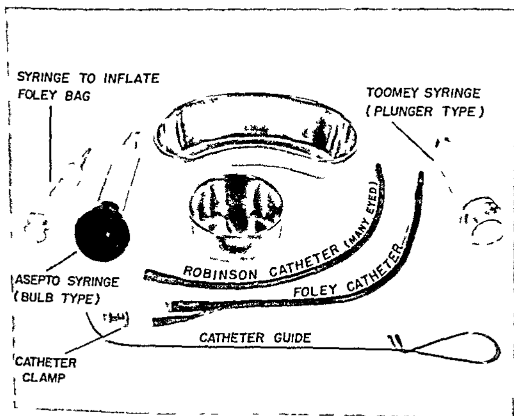


Figure 13 Illustration of supplies which are needed for catheterization of male patients in a recovery room

CHAPTER XI

Care of the Urological Patient

ROBERT M SPELLMAN, M D

For the urological patient maintenance of an adequate water way is second only in importance to the maintenance of an adequate airway

The Foley catheter (Figure 12) is a device for urinary drainage employed frequently in urology Essentially it is a rubber catheter within which there is another smaller tube connected directly with a rubber balloon at its inner proximal end After the catheter is introduced into the bladder the balloon is inflated to secure the

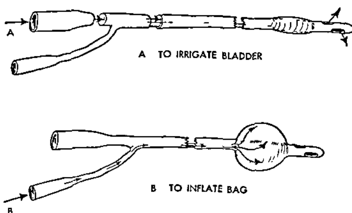


FIGURE 12 Diagram of Foley catheter

catheter into position The smaller inner accessory tube is then clamped Drainage takes place through the main lumen Frequently those not familiar with the apparatus will remove the clamp and irrigate the balloon system This is a dangerous maneuver since the catheter is likely to be displaced Frequent observations are neces sary to detect obstruction of catheters before serious damage can

patient manifest signs of excessive blood loss A nephrostomy is done to aid operative procedures on the renal pelvis or ureter In many cases a splinting catheter is passed through the operative area below the nephrostomy to support the repaired structures This splint may be brought out through either the pelvis or alongside the nephrostomy tube Such essential tubes should never be displaced, and great care should be taken to ensure that they remain open

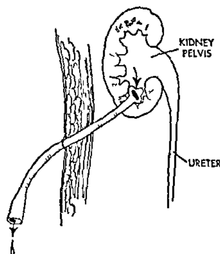


FIGURE 14 Nephrostomy tube in position

Occasionally a soft rubber T tube is placed in the ureteral lumen so that the limbs above and below support and splint the repaired ureteral walls Urinary drainage is established through either the longitudinal limb directing flow into the bladder, or through the horizontal limb conducting urine to the exterior (Figure 15) Much depends upon this tube as it not only provides drainage but supports the operative area as well Here, again, it is most important to protect such catheters to observe their patency, and to see that they are not removed or displaced inadvertently

In certain operations the ureter is divided close to the bladder and brought out on the skin of the anterior abdominal wall forming a cutaneous ureterostomy The ureteral ends are allowed to protrude several centimeters above the skin surface forming a ureteral bud The surgeon has made every effort to preserve the blood supply to the ureters It is of paramount importance to keep these buds viable so as to prevent future stricture or narrowing of the ureteral ends A valuable aid to these ureteral protusions is to moisten them with warm saline for several days following surgery Soft rubber

syringes assorted basins, and large quantities of sterile normal saline

The removal of a kidney surgically may be accomplished through the flank, the chest, or transperitoneally The surgical management of the transected renal vessels is extremely important because of their size Fatal exsanguination can occur in two to three minutes through an unligated renal blood vessel Individual ligation and division of each vessel is the safest surgical technique It is a common practice, however, to isolate the renal pedicle (the artery, vein, and surrounding fat), and to ligate and transfix all of these in one mass On rare occasions, due to anatomical or technical difficulties, neither technique may be possible and long clamps which protrude from the wound may be left on these vessels These clamps should not be handled by anyone but the surgeon in charge Rarely gauze packs may be left about the renal pedicle and brought out through the wound in the flank These must be removed only by the surgeon in charge

Nearly every nephrectomy wound is drained because of the large potential dead space remaining behind and because most kidneys which require removal are infected A sudden massive hemorrhage along the drain requires attention to shock immediately and the responsible surgeon must be notified Equipment and supplies with which to pack the wound (even without anesthesia if the situation demands) must be readily available Actually such occurrences are rare Although a moderate amount of bloody discharge following a nephrectomy is not unusual massive hemorrhage is obvious, usually from signs of shock and the inordinate amount of blood issuing from the wound Since kidneys are removed sometimes through the chest, the correct postoperative measures for the thoracotomy patient should be observed (See Chapter VII)

A nephrostomy is a connection established surgically between the renal pelvis and the body surface which passes through the substance of the kidney (Figure 14) A large rubber nephrostomy tube is utilized Its purpose is to establish the most efficient diversion of urine Since the kidney is a highly vascular organ occasionally severe and even exsanguinating hemorrhage may follow the damage to the renal substance caused by this procedure Bloody discoloration of the drainage is the rule during the immediate postoperative period but the tube should not become filled with clots nor should the

Vigorous irrigation of such tubes is obviously dangerous and must be avoided

A cystostomy is a communication established surgically between the lumen of the bladder and the exterior (Figure 16) This communication is established nearly always through an incision in the lower abdomen, immediately above the symphysis pubis (suprapubic incision) Here, again, a catheter is placed to establish drainage It should not be occluded without specific authorization from the responsible surgeon It is far better for the patient to be lying in a bed wet with urine than to be lying in a dry bed but with an obstructed urinary tract

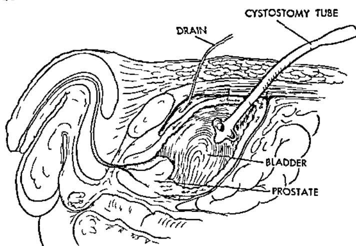


FIGURE 16 Suprapubic cystostomy tube in position

Foreign bodies, such as catheters, stimulate involuntary contractures of the bladder occasionally, and these spasms are usually painful The accumulation of blood clots within the bladder is also a common cause of spasms

In a suprapubic prostatectomy the prostate is bluntly enucleated through an incision which passes through the suprapubic region into the bladder Adequate control of bleeding is sometimes difficult This may be accomplished in several ways The most desirable way is to suture or fulgurate the bleeding points Because this is not always possible various methods of tamponade are frequently used The Pilcher bag (Figure 17) is a pear shaped rubber balloon, from the smallest end of which is attached a long rubber tube which passes out through the urethra Traction on this tube pulls the balloon snugly into the prostatic fossa thus controlling the bleeding by

catheters are placed nearly always through the ureters and up to the kidney so that urinary drainage will be unimpeded during the post operative period The importance of protecting these tubes cannot be overemphasized *During the immediate postoperative course, attention to drainage tubes can mean the difference between a short, smooth convalescence and a prolonged, complicated one*

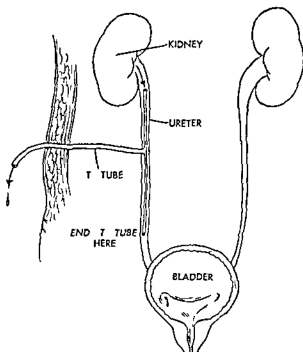


FIGURE 15 T tube in place in the right ureter

When both ureters are detached from the bladder and transplanted to the sigmoid (ureterosigmoidostomy), the flow of urine passes directly into the lumen of the bowel To prevent back pressure overdistension and leakage at the operative site a large rectal tube is left in place and attached securely to the leg Occasionally, due to temporary obstruction of the ureters by edema, no urine reaches the bowel for several hours following surgery The time that the flow begins should be recorded upon the chart The amount of drainage should be recorded also When the rectal tube does not drain properly, changing its position slightly may improve its patency If a slight change in position in either direction, does not produce the desired drainage the responsible surgeon should be called and another sterile tube should be ready for him by the bedside

this catheter remain unobstructed and drain freely If the bladder becomes distended with clots, not only is the patient uncomfortable but further bleeding will ensue

In transurethral prostatectomy or resection, prostatic tissue is cut out piecemeal with an electric instrument which functions through the urethra Bleeding is controlled by direct fulguration of bleeding points under direct vision A transurethral catheter is left in place this is most often of the Foley type In some institutions, these catheters are irrigated routinely to be certain that they remain open Several irrigating arrangements have been devised, and the one illustrated is perhaps the most readily assembled and generally efficient (Figure 18) It can be noted that by occluding alternate tubes

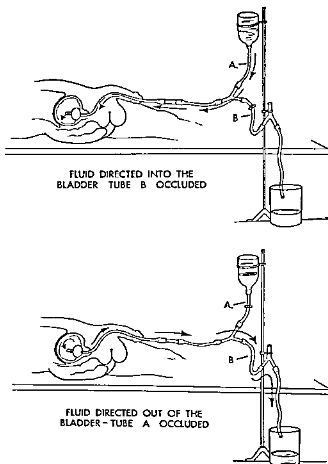


FIGURE 18 Intermittent bladder irrigations

connected to a Y tube on the end of a transurethral catheter, the bladder can be filled and emptied alternately The amount of fluid

direct pressure The balloon is filled by means of a second tube, which, with the cord to help in the removal of the bag are both attached to the top of the bag and protrude through the suprapubic wound The clamp in the second, upper catheter should *not be re moved* since this would deflate the bag and eliminate the desired effect of the tamponade Likewise, traction applied to the urethral portion of the apparatus must not be altered except on specific order

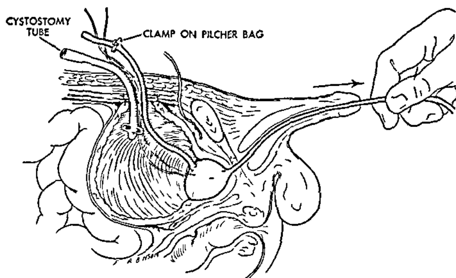


FIGURE 17 Pilcher bag positioned in the prostatic fossa

There are other types of hemostatic bags and the surgeon in charge must know the characteristics of each piece of apparatus Foley catheters with large balloons are also used in a similar manner Rarely, the prostatic fossa is packed with gauze or other materials Occasionally a large rigid suprapubic tube is left in the bladder (Freyer tube) and constant suction is applied to its outer end to promote urinary drainage The amount of blood coming from a postoperative prostatectomy should never be copious or tend to clot Bright red blood suggests the presence of arterial bleeding which is always of major importance The surgeon must be notified

In a retropubic prostatectomy the technique is similar to the suprapubic operation except that the bladder itself is not usually opened Removal of the gland is accomplished by an incision in the prostatic capsule Postoperative drainage is maintained by a trans urethral catheter, most often of the Foley type Since there is no free bladder drainage above (suprapubic) it is doubly important that

should also be guarded against Accurate records must be kept of all fluids used, and how they were administered The urinary output should be accurately noted and the amount recorded from each catheter, separately, if there are several Caution must be exerted in the use of irrigating fluids Excessive bleeding, sudden hypotension, bladder spasms and other postoperative urological emergencies should be reported immediately to the responsible surgeon It is the responsibility of the attending surgeon to acquaint the nursing staff with his particular postoperative techniques, since wide individual variations are common

used in this irrigation process must be accurately recorded so that the urinary output can be measured

In perineal prostatectomy, an incision is made through the perineum, and abnormal portions of the prostate are removed Bleeding is controlled either by suture, fulguration, or the use of hemostatic bags Usually, a Foley urethral catheter supplies drainage A complete prostatectomy is not a frequent procedure and is performed most often for prostatic cancer In complete prostatectomy (radical), the entire organ (adenoma and capsule) is removed, and the neck of the bladder is sutured to the amputated end of the urethra This operation is most commonly carried out through the perineum, but it can also be done through a retropubic approach In both instances, a transurethral catheter, usually of the Foley type is left in position for drainage and to splint the operative area Drainage from the prostatic region to the line of incision is invariably employed due to the possibility of infection, mild hemorrhage, or urinary leakage

In general the ordinary prostatectomy consists of removal of all or the greater portion of the hypertrophied masses (adenoma) within the prostatic capsule The capsular tissue contains numerous blood vessels and venous sinuses Hemostasis is more complete, usually after a total prostatectomy Drawbacks to a total prostatectomy however include the possibility of postoperative urinary incontinence and sexual impotence

Operations on the genitalia such as orchiectomy, circumcision, hydrocelectomy and plastic operations on the penis follow the rules of general surgical and urological postoperative care

Since urological surgery regularly involves the aged problems peculiar to the geriatric patient deserve mention In general, sedation must be used sparingly blood loss must be kept at a minimum, and of great importance the blood pressure must be maintained Maintenance of blood pressure prevents damage to kidneys brain and myocardium by vascular collapse which is often irreversible Alert postoperative care of these poor risk patients is most gratifying since catastrophe can often be so easily avoided

Summary

Since the primary function of a catheter is drainage any obstruction of it should be avoided Any change in position of the catheter

knowledge of these complications will lead to their early detection and facilitate their correction once they arise

The postoperative and recovery room care of a tonsillectomy case begins actually in the operating room No patient should leave the operating room until all bleeding is stopped and all secretions have been suctioned and removed from the airway Most surgeons prefer to have the patient who has had anesthesia well asleep when he is sent to the recovery room so vomiting is delayed and the vascular clots will have more time to become adherent before vomiting occurs When the patient is placed in his bed, he should be turned on his side in Sims position The arms should be free so as not to incur temporary or permanent palsy from bodily pressure The foot of the bed should be elevated to allow for drainage of secretions by gravity and, thus to prevent aspiration

The most common local complication of tonsillectomy and/or adenoidectomy, which may be detected and dealt with in the recovery room is primary hemorrhage This is hemorrhage which is initiated at the time of operation or in the immediate postoperative period

When the patient reaches the recovery room, he should be observed closely for signs of bleeding Should bleeding occur in any quantity the surgeon should be notified The blood hemorrhage should be saved for the surgeon s inspection so he may estimate the amount of blood lost Patients who are not fully conscious (especially young children) will swallow blood This possibility must be borne in mind because the patient may bleed seriously and sometimes fatally without others being aware of it Frequent swallowing movements of the throat may be the earliest sign indicating hemorrhage, and when noted immediate investigation is demanded for possible hemorrhage

If a moderate (or severe) hemorrhage should occur in the recovery room in a patient who has had a tonsillectomy or a combined tonsillectomy and adenoidectomy the hemorrhage may be cared for in the recovery room However, most surgeons prefer to return young children to the operating room and place a ligature, or a suture or insert a postnasal pack Older patients may be treated in the recovery room Severe hemorrhage can rarely be cared for without administering a general anesthetic These cases are returned to the operating room

CHAPTER XII

Care of the Ear, Nose, and Throat Patient

JAMES M HOLMAN M D

In the past, many surgical procedures of the ear, nose and throat system were carried out under local anesthesia, hence these patients did not require the services of trained recovery room personnel With the advent of improved general anesthesia more of these patients are now sent to the recovery room for immediate postoperative care

The importance of adequate recovery room care cannot be stressed too much because the dangers of respiratory obstruction and aspiration of secretions are manifold in operations involving the upper respiratory system

Recovery room care that is special to ear, nose, and throat patients resolves itself into the following categories

1 Frequent observations for early detection of hemorrhage
2 The maintenance of an adequate laryngeal airway
3 The prevention of the aspiration of secretions
4 The awareness of possible cerebral complications

Tonsillectomy either alone or in combination with adenoidectomy accounts for the majority of ear, nose, and throat patients who receive recovery room care Over one million of these procedures are performed in the United States each year General anesthesia is used for children under the age of 16 years Local anesthesia is frequently used for adults and those in their late teens although many surgeons prefer general anesthesia for all patients The majority of tonsillectomy patients who receive recovery room care therefore, are children and young adults The recovery room is the first place where these complications might be noted in these patients A

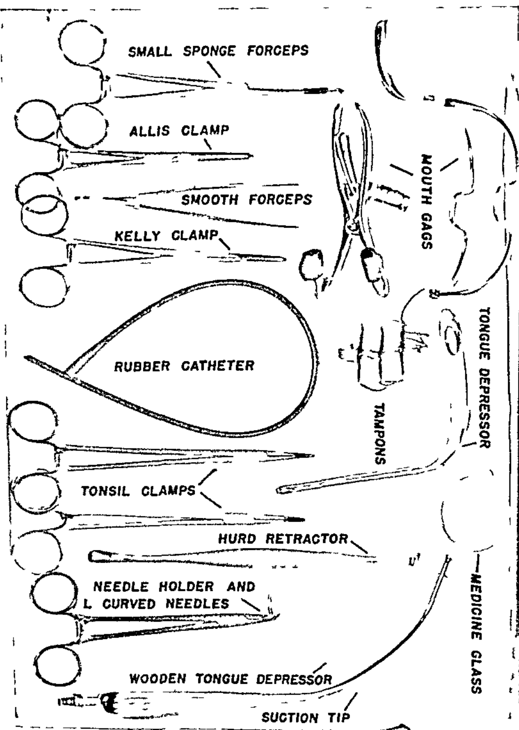


FIGURE 19 Equipment needed for management of post tonsillectomy hemorrhage

Certain special equipment should be available immediately, in the recovery room, for the care of these cases which may hemorrhage postoperatively The necessary equipment which should be available in the recovery room includes (Figure 19)

1 A source of illumination (a gooseneck lamp and head mirror, or a head light)
2 A tray containing the following instruments

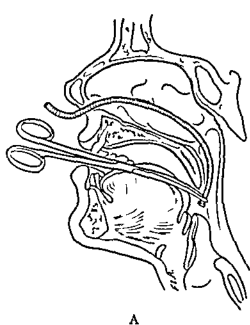
1 metal tongue depressor	1 needle holder
Wooden tongue depressors	1 medicine glass
1 Hurd retractor	1 basin (round) for sterile water
2 mouth gags	Cotton balls
1 Allis clamp	Tonsil tampons
2 tonsil hemostats	1 catheter
1 sponge forceps (short)	Petrolatum
1 pair scissors	

3 Other equipment

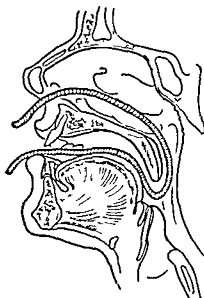
1 set sterile tonsil suture needles in glass tube
30 ml epinephrine hydrochloride 1 1000 (Adrenalin)
Sterile towels
Suction machine with necessary suction tips

There are other types of ear, nose and throat postoperative cases which come to the recovery room for care Among them are those who have had laryngeal surgery Although these types of cases are not seen as frequently as tonsillectomies or combined tonsillectomies and adenoidectomies they require closer surveillance to prevent complications As mentioned previously one of the most important duties of a recovery room team is to see that an adequate airway is maintained and in no instance is this awareness more important than in those cases who have had laryngeal surgery

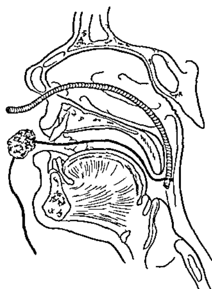
Most laryngologists agree that the most crucial period in the post operative course in patients who have had laryngeal surgery is within the first 12 hours after surgery For this reason many institutions require that these cases spend the first 12 postoperative hours in the recovery room In some cases a tracheostomy has been performed as a preliminary step In general effective recovery room care of postoperative laryngeal surgical cases hinges upon an awareness of the possibility of hemorrhage (which may be of quantity



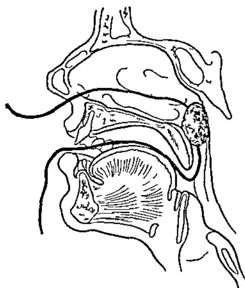
A



B



C



D

FIGURE 20 The nasal pack may be easily inserted by passing a soft rubber catheter through the nares and grasping the tip in the posterior pharynx (*A*) The catheter can then be pulled through the mouth (*B*) and a suitable nasal packing attached (*C*) Traction on the nasal end will pull the postnasal pack into place (*D*)

sufficient to occlude the tracheostomy tube) or the presence of accumulated secretions which may occlude the tube also These patients are apprehensive usually, and this apprehension may be exaggerated further by respiratory embarrassment and excessive coughing It must be remembered that these patients are without voice, and complications must be detected through frequent observations, rather than by word from the patient that all is not well

Effective postoperative recovery room care consists of maintaining the airway This can be attained by frequent cleansing and suctioning of the tracheostomy tube, by frequent observations for excessive bleeding, and by giving frequent reassurance to the patient that he is breathing properly Many patients have Levin tubes in place At times the patient will try to remove these tubes, and efforts must be exerted to prevent removal of the tubes by the patient

Patients who have had nasal or sinus surgery are not transferred to the recovery room because most of these procedures are carried out under local anesthesia Their immediate postoperative management consists of maintaining an adequate airway through frequent suctioning of secretions and observations to see that dressings remain in place As a rule most of these patients will have some type of packing placed in the nasal or sinus cavities, and this is usually reinforced by a firm, outer dressing Despite meticulous care in the operating room the packing may drop into the pharynx or nasopharynx and cause respiratory distress Also, the patient who is recovering from a general anesthesia may attempt to pull or remove the outer dressing and thus dislodge the nasal packing When this happens bleeding ensues and repacking by the surgeon is necessary (Figure 20)

Cerebral complications following nasal or sinus surgery are rare They are seen nevertheless The first sign usually is a sudden marked elevation of temperature The patient will become restless Excessive or projectile vomiting may occur If he is conscious, the patient may complain of headache and stiffness of the neck Notification of the surgeon is imperative if such signs are noted

The recovery room management of patients who have had ear surgery is a rather simple matter usually because immediate complications are rarely seen Occasionally excessive bleeding may be detected, especially if a large blood vessel has been entered during operation As soon as the patient regains consciousness the function

CHAPTER XIII

Care of the Orthopedic Patient

LEE RAMSAY STRAUB, M D

The recovery room care of the orthopedic patient differs only slightly from that of other postoperative cases still under anesthesia In the basic matters of fluid replacement, freedom of the airway, and sedation during the reactive phase, the orthopedic patient's problems are identical to other patients In fact, the problem of fluid balance is usually less complicated in the orthopedic case than in the patient who has undergone abdominal surgery A majority of orthopedic operations are performed on extremities with little loss of blood However, operative procedures on the pelvis, hips, or the spine may be accompanied by massive loss of blood During such procedures whole blood is administered usually in sufficient quantities to prevent postoperative circulatory collapse, but the possibility of this occurrence must be recognized In some operations, large areas of bone may be denuded or entered, making hemostasis difficult There may therefore be rather severe postoperative hemorrhage which may contribute to or cause, a delayed circulatory crisis If excessive bleeding is recognized through dressings or cast, the surgeon should be notified immediately If the bleeding occurs from an extremity encased in plaster elevation of the extremity may be all that is required If the bleeding occurs from a spinal or hip wound or from an extremity which is not immobilized in plaster additional compression dressings are usually all that is required Impending shock resulting from blood loss is best treated by replacement with whole blood in sufficient quantity by the administration of oxygen, and in some instances the use of Trendelenburg position for short periods

of the facial nerve should be tested by having the patient wrinkle his forehead close his eyes, and smile A note should be made upon the patient s chart as to whether or not he can perform these functions In instances where the semicircular canals have been entered during operation the patient may complain of vertigo upon regaining consciousness When this is severe, the patient may fall or roll out of bed, and for this reason, it is advisable to use side boards

a certain amount of adjustment and trimming at the time of application which may be insufficient. After checking the patient's vital signs, the recovery room staff should check the cast thoroughly for

1. Freedom of respiratory motions in casts that cover any portion of the thorax
2. Any deep depressions or plaster edges that may be causing skin pressure. (Many decubiti have their origin during the time the patient is anesthetized.)
3. Adequacy of trimming of the cast at the perineum for cleanliness (especially in infants), at the sacrum to avoid pressure, and at the hands and feet in extremity casts. All digits should be visualized. (This will be considered further under extremities.)

Skin pressure at the edge of a cast can be overcome often, simply by posturing the patient properly. For example, a patient supine in a heavy spica may have damaging pressure on the skin of the thorax dorsally at the upper margin of the cast. Pillows placed beneath the upper thorax, neck and head will level the bodily contour and relieve the pressure. This of course holds true for the proximal edges of extremity casts as well. When possible casts should be open to the air for proper drying. (Drying machines should *not* be applied to casts on unconscious patients and should *never* be used on infants or small children. There is a real risk of incurring a serious burn from a drying machine.)

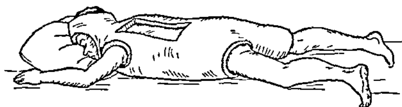
Postoperative Positioning and Care in Surgery to the Extremities

The Foot. Following operations on the toes for bunions, hammer toes, or similar conditions plaster of Paris casings may, or may not, be employed. In any event gauze or cotton padding is usually placed between the toes. Since the dressing is intended to be moderately compressive, embarrassment to circulation of the toes is a possibility. Such dressings should allow visual inspection and palpation of the tips of each of the toes. Should the toes be swollen, cold, pale or cyanotic, the surgeon must be called. He should also be notified if the toes cannot be visualized sufficiently.

In reconstructive bone or tendon surgery at the feet and ankles, casts are employed that extend from toes to just below the knee or to the upper thigh. As stated above, all toes encased must be exposed sufficiently for visualization. The first cast should expose only the

Maintenance of the Airway

Plaster of Paris fixation of the head, neck, and upper thoracic areas provides a certain risk in the anesthetized patients and demands extra watchfulness during the recovery period In the instance of spinal fusion for scoliosis the cast may have been applied preoperatively with the operation performed through a fenestration in the plaster (Figure 21A) In these cases, the cast is applied with care to



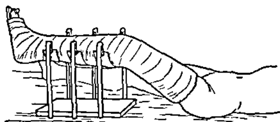
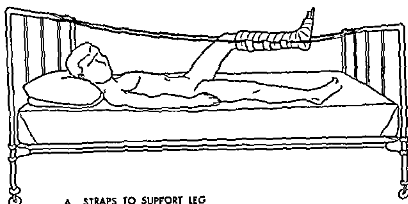


FIGURE 21 *A* Type of cast applied for spinal fusion for scoliosis *B* Postoperative leg support for holding freshly casted leg in elevated position

provide freedom from pressure to the mandible and the anterior aspect of the neck Frequent check of respirations and of pressure in the tracheal region from position is essential during the patient s stay in the recovery room This is often difficult because of the prone position of the patient in a large cast Similarly there is a risk of interference with the airway in spinal fusion in the cervical or dorsal area and following surgery for the correction of torticollis or wry neck These latter cases may be dressed with a soft thyroid type of dressing or a cast postoperatively In either case mechanical obstruction of the trachea is a possible danger

Body Jackets Spicas Plaster of Paris Casts

Plaster casts have been applied usually just before the patient s arrival in the recovery room Normally plaster casts have received



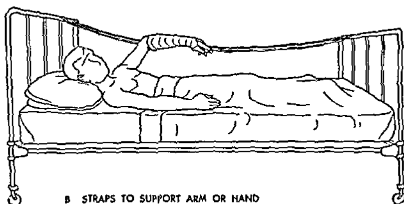


FIGURE 22 *A* Simple method to support lower extremity *B* Simple method of support which may be applied for elevation of either arm or hand

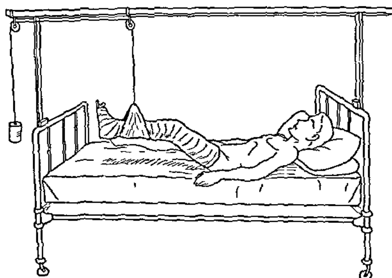


FIGURE 23 Overhead suspension from Balkan frame either fixed or balanced

distal phalanges of the toes If the webbed portion of the foot is exposed this early, excessive swelling may result Trimming to allow motion of the toes is performed one week postoperatively The plantar portion of the cast should extend beyond the toes to prevent pressure on the toes by blankets The proximal edge of short leg casts (those extending up to, but not above, the knee) must be checked for pressure near the head of the fibula Excessive pressure here may do permanent damage to the peroneal nerve, resulting in paralysis of the muscles that dorsiflex the foot

The patient is commonly supine The operated foot must be elevated The Whitman astragalectomy rack (Figure 21B) provides an excellent means of holding a freshly casted leg in the elevated position before and just after transferral from the operating table In bed, the leg can be raised on the elevated lower end of the Gatch bed The leg requires lateral support by pillows and/or sandbags This method has disadvantages As both legs are elevated the hamstring muscles of the uninvolved leg are put under tension and back pain may ensue A better method is to place the patient with his head at the *foot of the bed A pair of heavy webbing straps,* 3 in apart are stretched tautly from head to foot of the bed (Figure 22A) The casted leg is tied securely between these straps in the elevated position This allows secure fixation that will not be disturbed by the patient during sleep The cast is exposed to air in this fashion Elevation may be obtained similarly if an overhead pipe or Balkan frame is attached to the bed (Figure 23) Ice bags applied to the region of operation help to relieve pain and minimize swelling in the foot

The Knee Following meniscectomy the most frequent operation upon the knee, the knee is immobilized in extension This may be accomplished by a plaster cylinder extending from ankle to groin or by soft compressive bandage over the whole area If the latter is used the elastic bandage is started best at the toes and extended to the groin A decubitus at the instep may result from excessive pressure over the ankle with edema of the foot The leg should be elevated on pillows without allowing flexion of the knee Hyperextension must be avoided similarly

Fractures and some reconstructive procedures of the lower extremities require postoperative support of the leg in a Thomas splint with or without skeletal or pin traction a plaster cast, or a Pearson

In virtually all extremity plasters, either for leg or arm, it is safer practice to split the cast postoperatively than to risk insufficiency of the circulation It is essential that the division of the plaster include division of the underlying padding so that the skin is exposed, as dry blood upon padding may produce a rigid, board like band around the extremity

Operations about the shoulder may require the use of large shoulder spicas of plaster This is especially true in the arthrodesing operations upon this joint Positioning for comfort and ease of respiration may be difficult postoperatively Such patients usually do better if elevated to a low Fowler s position In the straight supine position, this cast tends to ride up and the neck portion may cause pressure over the tracheal area A patient in a shoulder spica can be turned on his unaffected side with the plastered arm elevated and held between webbing straps running from the head to the foot of the bed An overhead Balkan frame will make this support easier and will provide a trapeze later so that the patient can assist himself in getting into and out of bed

Traction

Postoperatively, many extremities are immobilized or supported by various types of traction The precautions for skeletal pin traction have been mentioned above Skin traction is achieved usually by using adhesive with a compression bandage molding the straps to the extremity Sponge rubber may be substituted for adhesive The recovery room staff should check these traction applications carefully for any undue signs of pressure Common points of complications from pressure are over the instep and behind the heel in the lower extremity and at the antecubital fossa in the upper extremity when traction is applied to the shoulder with the elbow flexed to 90 deg

After major surgery (especially spinal fusion), care must be exerted in positioning the patient and in shifting the patient suddenly during the recovery phase The anesthesiologist should be consulted as to whether a patient who has been prone during the operation may be turned As far as the wound is concerned the patient in plaster is safe in any position desired by the anesthetist In operations upon the lumbar spine for disc or localized spinal fusion plaster cast fixation is sometimes employed If the patient is placed in

splint attachment Such apparatus requires careful adjustment In the recovery room the staff must check carefully for any possible points of skin pressure and if found, request inspection and adjustment by the surgeon If pin fixation (Kirschner or Steinmann pins) has been employed the exposed ends should be covered by cork, tape or plaster to avoid wounding the uninvolved leg or the persons in attendance

The Upper Extremity Following surgery to the hand, dressings are purposely compressive and usually bulky Plaster may or may not be employed The fingers are usually flexed Here again it is desirable to see at least a portion of every finger If they are cold, pale excessively swollen or fail to show normal return of color after pressure, a report should be made to the surgeon While compression is desirable for hemostasis, excessive pressure by cast, or elastic bandage, may cause ischemic changes in the hand with serious permanent damage Postoperatively, hands should be elevated to the level of the heart Some fixation of this position is desirable to prevent shifting when the patient turns This is best accomplished by tying the hand between the heavy webbing straps extending from the head to the foot of the bed

Operative procedures at the elbow are fixed postoperatively usually in a position of flexion approaching a right angle During the immediate postoperative course the operative area should be elevated *In this instance, the elbow should be supported in the webbing straps* so that the arm is held abducted and in forward flexion of 90 deg each (Figure 22B) The condition of the fingers must be observed It may also be advisable to adjust the dressings to allow for palpation of the radial pulse This observation of circulation in the hand becomes vitally important in the postoperative management of fractures or dislocations about the elbow, especially in children Such fractures are frequently treated in the flexed position Swelling resulting from the original trauma or the reduction may effect musculature and nerves producing Volkmann s ischemia Palpation of the radial artery is essential in these cases and passive extension of the fingers should be frequently tested If there is inability to extend the fingers, and if the attempt is accompanied by pain, dressings about the elbow should be released by the surgeon Delay in this may lead to permanent changes and paralysis in the extremity

CHAPTER XIV

Cardiac Arrest in the Recovery Room

GEORGE R HOLSWADE, M D

Physiologists and physicians have been interested in resuscitation of the heart following sudden arrest since Schiff (1874), experimenting with dogs, stopped their hearts with chloroform and restarted them with massage In 1902 Starling and Lane first reported a successful human case of cardiac arrest with recovery Since that time, cardiac resuscitation has been attempted repeatedly Hinton recently collected 1344 cases with an overall survival rate of 28 per cent

The term *cardiac arrest* refers to sudden loss of propulsive power of the heart Cardiac arrest may occur upon the operating table, during diagnostic procedures (such as cardiac catheterization), and during the immediate postoperative period while the patient is in the recovery room This loss of propulsive power is due to either (1) cardiac standstill, or (2) ventricular fibrillation, two separate conditions with the same result In cardiac standstill (asystole), the heart has stopped and is motionless, dilated, soft, cyanotic and flabby In ventricular fibrillation, individual muscle fibers of the heart are contracting but without coordination so that the surface is rippled by multiple waves The heart has the feel of a bag of worms One condition may follow the other What was originally cardiac standstill may proceed to ventricular fibrillation Ventricular fibrillation when treated successfully is frequently followed by a period of standstill

Etiology

Most authorities agree that lack of an adequate amount of oxygen (hypoxia) is the cause of the greater number of cardiac arrests

the supine position postoperatively, he will be resting on bulky dressings This has produced decubiti in the past and is to be avoided The patient should be placed either prone or on his side for the first 24 hours At that time the heavy dressings, which are now filled with blood are changed and the patient is allowed to be turned into the supine position

Occasionally, reconstructive procedures are done on paraplegics These patients have been shown to have a very labile circulatory system especially if the level of their spinal lesion is above T 5 They may develop vasoconstriction of the extremities and may proceed into a hypertensive phase during the surgery which may be followed by a considerable drop in blood pressure in the postoperative period These patients require very careful observation during and immediately after any general anesthesia

In summary special problems of the orthopedic patient in the recovery room are concerned with his fixation in apparatus One must be sure that the apparatus does no harm by obstructing the airway, by excessive pressure to skin, or by excessive constriction of an extremity

In the recovery room, close attention given to the maintenance of an adequate airway and the use of O_2 will prevent hypoxia Prior to suctioning the pharynx or trachea, the patient should receive O_2 Suctioning should not be done roughly or unnecessarily, thus decreasing the likelihood of cardiac arrest through a vago vagal reflex

Certain changes in vital signs herald the development of serious complications Progressive hypoxia produces uniform changes in the pulse and blood pressure In the early stages of hypoxia the blood pressure is elevated and the pulse rapid As the hypoxia progresses and becomes severe, the pulse rate and blood pressure may fall precipitously and be followed shortly thereafter by cardiac standstill In respiratory acidosis, caused by accumulation of CO_2 during operation, the blood pressure also tends to be elevated It falls abruptly toward normal with return of the normal blood pH as the patient breathes room air or O_2 So a falling blood pressure and slowing of the pulse following a period of hypertension are ominous signs which should alert the recovery room staff to the danger of impending cardiac arrest

Diagnosis or Recognition

It is in the recognition of cardiac arrest that the recovery room nurse has her greatest responsibility Early, almost immediate, recognition is of utmost importance if successful treatment is to be carried out If the heart is stopped for longer than three minutes at normal temperatures, irreparable damage is done to the sensitive cells of the brain In the operating room the anesthetist is devoting his entire attention to the patient Fall in blood pressure, cessation of heart action and cessation of respiration are noted immediately Such individual attention is not possible, nor practicable, in the recovery room There may be 15 to 20 minute intervals between recordings of vital signs so that these cannot be depended upon Following cardiac arrest, respirations stop within seconds An alert nurse even though not at the bedside of the patient, should perceive that the patient is not breathing She will also note the deathly pale countenance the so called pale asphyxia As she calls the recovery room supervisor she should confirm the diagnosis of cardiac arrest by palpating the pulse and listening for heart sounds

However, the role of hypoxia has been challenged by others who feel the vago vagal reflex is more important The vago vagal reflex is set up by stimulation of afferent vagal nerve fibers by actions such as intubation, extubation, suctioning the trachea or pharynx, or by passage of intragastric tubes The efferent vagal component of the reflex arc then slows or even stops the heart It has been demonstrated that in the presence of hypoxia the vago vagal reflex is more easily set into action and is apt to produce a standstill of more than temporary duration

Overdoses or sensitivity to anesthesia have long been recognized as causes of cardiac arrest More recently, a multiplicity of drugs and anesthetic agents have been blamed In certain operative procedures, especially those on the chest CO_2 has been found to accumulate in the body in excessive amounts (hypercapnia), resulting in a respiratory acidosis with a lowered pH of the blood This state of hypercapnia is accompanied by an elevated blood pressure and a slow heart rate The danger comes when room air or pure oxygen is breathed, and CO_2 is removed rapidly from the body with sudden rise in blood pH It is in this setting that ventricular fibrillation frequently occurs

Although the majority of cases of cardiac arrest occur in the operating room it can readily be seen that under certain conditions such a catastrophe can occur in the recovery room The patient with the slowly developing hypoxia which is unsuspected, the patient with the partially obstructed airway whose trachea is suctioned, the chest case who is extubated and returned to room air or O_2 are all candidates for cardiac arrest

Prevention

Certain measures taken by the surgeon and the anesthetist before and during the operation should be of interest to the recovery room staff although not their direct concern Close cooperation between the surgeon and the anesthetist is required In addition to its use preoperatively atropine may be repeated during or near the close of long procedures, to prevent vago vagal reflexes The use of fewer combinations of drugs and anesthetic agents is advisable The anesthetist must strive to avoid hypoxia and hypercapnia Caution should be exercised at the time of extubation and return of the patient to room air or O_2

the heart, artificial respiration must be given Positive pressure O_2 by mask may be used at first, and intubation carried out at the con venience of the anesthetist Once cardiac compression and artificial respiration are in effect, the urgent need for speed is over, and the next steps in treatment may be considered in a more deliberate manner

The foot of the bed should be elevated to increase the flow of blood to the brain Intravenous fluids, or whole blood given rapidly, will promote filling of the heart In some cases of standstill, the heart will start again after only a few compressions, and no drugs may be necessary If the heart in standstill fails to start to beat, the surgeon may elect to inject epinephrine (0 1 ml of 1 000 solution) or calcium chloride (5–10 ml of 10 per cent solution) into one of the ventricles

In cases of ventricular fibrillation the electrical defibrillator should be used This consists of two flat disc shaped electrodes con nected to an electrical transformer capable of delivering from 130 to 270 volts Through these electrodes covered with gauze and moistened with saline, electrical shocks, singly or in series are given directly to the heart By this means, ventricular fibrillation is converted into normal sinus rhythm or into standstill which is treated by intermittent compression and drugs as indicated All personnel are instructed to stand away from the patient and the bed when the defibrillator is in use to avoid accidental shocks which could be lethal The handles of the electrodes are well insulated but the operator must wear rubber gloves for protection

Efforts to resuscitate the heart may be continued for several hours before they are abandoned as unsuccessful If resuscitation is successful a closure tray is obtained from the operating room, and the chest is closed carefully under aseptic conditions The successfully resuscitated patient remains in the recovery room until all vital signs have stabilized and he is considered out of danger This may require 24 hours, or more of constant care and attention

Table III is a timetable of events taking place when a cardiac arrest occurs in the recovery room It shows what various individuals would do in a hypothetical case The importance of early recognition and immediate institution of cardiac massage cannot be emphasized too often The first doctor available on the scene be he surgeon anesthetist attending or house staff doctor should open the chest

Treatment

The initial treatment in cardiac resuscitation is intermittent manual compression of the heart, or cardiac massage This must be instituted within three minutes after the arrest The sooner it is instituted, the better The chest is opened (without sterile precautions in most cases) through the fifth intercostal space on the left The heart is compressed intermittently between the thumb and fingers

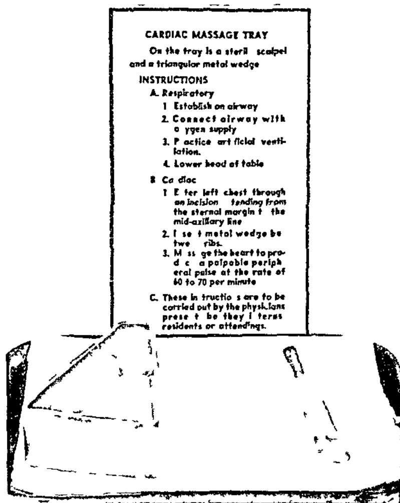


FIGURE 24 Cardiac massage tray

at a rate of between 60 to 80 times per minute When this is done correctly, a peripheral pulse is palpable

Simultaneous with the institution of intermittent compression of

TABLE III

TIMETABLE FOR A HYPOTHETICAL CASE OF CARDIAC ARREST IN THE RECOVERY ROOM

TIME (Min)	Recovery Room Nurse No 1	Recovery Room Supervisor or Head Nurse	Recovery Room Nurse No 2	Surgeon	Anesthetist	Resident or Intern
	Notes patient not breathing (pale asphyxia) calls supervisor notes absent pulse brings cardiac arrest tray to bedside	Calls surgeon and anesthetist notes time elevates foot of bed	Starts oxygen by mask			
1	Assists surgeon	Keeps written record	Brings cardiac drug tray to bed side	Confirms cardiac arrest Prepares to open chest performs thoracotomy exposes heart which is in standstill starts cardiac massage	Positive pressure oxygen by mask	Checks I V set
1½	Obtains additional clamps and instru ments	Has patient placed on critical list priest or chaplain notified			Establishes effective ness of massage by palpating peripheral pulse	Starts transfusion
2	Stands by to prepare any medication sur geon may request	Circulates	Prepares electrical defibrillator for use	Opens pericardium finds ventricular fibrillation massage continued		Pumps blood
3					Completely inflates left lung	
4	Sets up closure tray			Electrical shock heart defibrillated normal beating re sumed		Alternates with surgeon in continu ing cardiac massage
				Chest closed		

without hesitation, when the indications are present Because there is so much happening within a short period of time, it is often difficult to reconstruct the order of events with the proper time intervals For this reason, it is important that one responsible individual (the recovery room supervisor) make a written record of the time at which various events occur, the time arrest is noted, the time the chest is opened, the time massage is started, the time medications are given It is suggested that this individual call out the time at 30 second intervals

Summary

Cardiac Arrest —Loss of propulsive mechanism of heart, due to

1 Cardiac standstill
2 Ventricular fibrillation

Etiology

1 Oxygen lack (hypoxia—anoxia)
2 Vago vagal reflex—produced by stimulation of trachea pharynx, or esophagus
3 Overdose or sensitivity to drugs or anesthetic agents
4 Sudden rise in blood pH—accumulation of CO_2 in O R pH rises when patient begins to breathe room air or oxygen

Prevention

1 Close cooperation between anesthetist and surgeon
2 Use of fewer combinations of drugs and anesthetic agents
3 Maintenance of high O_2 saturation of blood and normal CO_2 levels
4 Slow heart rate and falling blood pressure are ominous signs

Diagnosis

1 Early recognition vital for success
2 Routine observations not reliable for early detection
3 "Pale asphyxia"—respirations stop a few seconds after the heart stops

Treatment

1 Intermittent manual compression of the heart, cardiac massage must be started within three minutes following arrest

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2 Artificial respiration must be started at once—CO_2 by mask at first, intubation later
3 Elevation of foot of bed
4 Intravenous fluids and blood
5 Drugs—intracardiac usually (epinephrine calcium chloride procaine, procaine amide [Pronestyl] potassium chloride)
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